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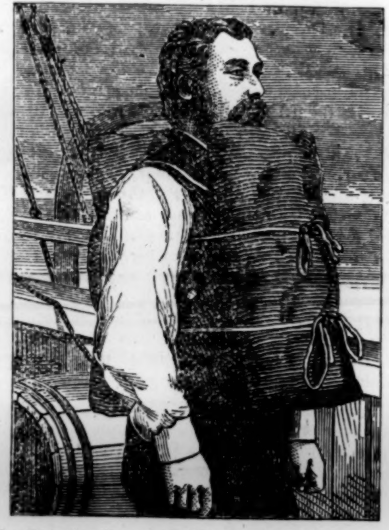

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(*Continued on page* 141).

THE BRITISH ASSOCIATION, 1875.

After being tossed about on the ocean it is pleasant to find oneself safely landed on *terra firma*; and this must be pretty much the feeling of the British Association now meeting at Bristol under the presidency of Sir John Hawkshaw. For several years past we have had the presiding member of this great organisation entertaining us with grand speculations drawn by his own mental vision from the researches of himself and others. It is needless to say that these speculations were generally of a kind distasteful to men of religious feeling, and that after all they were not supported by proofs so unassailable as to command for them the position of absolute verities.

The present president's address is, in tone and character, well described by the immediate past president, Professor Tyndall, who introduced Sir John Hawkshaw to the chair by saying:—

"In him you will have a wise and prudent head—a leader not likely to be caught up into atmospheric vortices of speculation. (Cheers.) He is not likely to quibble about things organic and inorganic, about mind or matters beyond the reach of mind, but he will be ever ready to maintain a refreshing contact with his mother earth. (Laughter.) I have long looked forward to the crowning act of his professional career—that of giving our perturbed spirits rest when we visit our fair sister France. (Cheers.) But pending that achievement, it will be pleasant to see him guide the ship of the association through calm waters rather than those tempestuous seas which those who preceded him felt it their duty to encounter rather than avoid. (Cheers.) To his strong hand I commit the helm of our noble bark, wishing him not only success but triumph in the task he has undertaken, and which I now call upon him to fulfil." (Loud cheers.)

As might be expected, Sir John's discourse had reference to engineering and practical science, its past history, present prospects, and future hopes. He briefly referred to the great works of ancient days, to the history of steam-power and steam navigation, and then proceeded as follows:—

As regards the dimensions of steam boats, we have at present somewhat overstepped the limits in the Great Eastern, but much still remains to be done in perfecting the form of vessels, whether propelled by steam or driven by the force of the wind. A distinguished member of this association, Mr. Froude, has now for some years devoted himself to investigations carried on with a view to ascertain the form of vessel which will offer the least resistance to the water through which it must pass. So many of us in these days are called upon to make journeys by sea as well as by land that we can well appreciate the value of Mr. Froude's labours, so far as they tend to curtail the time which we must spend on our ocean journeys, and we should all feel grateful to him if from another branch of his investigations, which relates to the rolling of ships, it should result that the movement in passenger vessels could be reduced. A gallant attempt in this direction has lately been made by Mr. Bessemer—whether a successful one yet remains to be proved. In any event, ~~he~~ and those who have acted with him deserve our praise for an experiment which must add to our knowledge. It is a question of vital importance to the steam boat that the consumption of fuel should be reduced to the smallest possible amount, inasmuch as each ton of fuel excludes a ton of cargo. As improvements in the form of the hull are effected, less power—that is, less fuel—will be required to propel the vessel through the water for a given distance. Great as have been the improvements effected in marine engines to this end, much still remains to be done. Wolt's compound engine, so long overlooked, is, with some improvements, being at last applied. Where the consumption of fuel in such vessels as the Himalaya used to be from 5lb. to 6lb. of fuel per effective horse power it has been reduced, by working steam more expansively in vessels of a later date, to 2lb. Yet, comparing this with the total amount of energy of 2lb. of coal, it will be found that not a tenth part of the power is obtained which that amount of coal would theoretically call into action. We live in an age when great discoveries are made, and when they are speedily taken advantage of if they are likely to be of service to mankind. In former times, man's inventions were frequently in advance of the ages, and they were laid aside to wait a happier era. There were in those earlier days too few persons who cared to, or who could, avail themselves of the proffered boon, and there was no sufficient accumulation of wealth to justify its being appropriated to schemes which are always in their early stage more or less speculative. There is no more remarkable instance of the rapid utilisation of what was in the first instance regarded by most men as a mere scientific idea than the adoption and extension of the electric telegraph. Those who read Odlier's letter written in 1773, in which he made known his idea of a telegraph which would enable the inhabitants of Europe to converse with the Emperor of Mogul, little thought that in less than a century a conversation between persons at points so far distant would be possible. Still less did those who saw in the following year messages sent from one room to another by Lesage in the presence of Friedrich of Prussia realise that they had before them the germ of one of the most extraordinary inventions among the many that will render this century famous. The first useful telegraph was constructed upon the Blackwall Railway in 1838, Messrs. Wheatstone's and Cooke's instruments being employed. From that time to this the progress of the electric telegraph has been so rapid that at the present time, including land lines and submarine cables, there are in use in different parts of the world not less than 400,000 miles of telegraph. Among the numerous inventions of late years, the automatic telegraphs of Mr. Alexander Bain, of Dr. Werner Siemens, and of Sir Charles Wheatstone, are especially worthy of notice. Mr. Bain's machine is chiefly used in the United States, that of Dr. Werner Siemens in Germany. In this country the machine invented by Sir Charles Wheatstone, to whom telegraphy owes so much, is chiefly employed. By this machine, after the message has been punched out in a paper ribbon by one machine on a system analogous to the dot and dash of Morse, the sequence of the currents requisite to transmit the message along the wire is automatically determined in a second machine by this perforated ribbon. This second operation is analogous to that by which in Jacquard's loom the motions of the threads requisite to produce the pattern is determined by perforated cards. By Wheatstone's machine errors inseparable from manual labour are avoided; and what is of even more importance in a commercial point of view, the time during which the wire is occupied in the transmission of a message is considerably diminished. By the application of these automatic systems to telegraphy the speed of transmission has been wonderfully accelerated, being equal to 200 words a minute; that is, faster than a shorthand writer can transcribe, and, in fact, words can now be passed along the wires of land lines with a velocity greater than can be dealt with by the human agency at either end. Owing partly to the retarding effects of induction, and other causes, the speed of transmission by long submarine cables is much smaller. With the cable of 1858 only 2½ words per minute were got through. The average with the Atlantic cable, Dr. C. W. Siemens informs me, is now 17 words, but 24 words per minute can be read. One of the most striking phenomena in telegraphy is that known as the duplex system, which enables messages to be sent from each end of the same wire at the same time. This simultaneous transmission from both ends of a wire was proposed in the early days of telegraphy, but, owing to imperfect insulation, was not then found to be practicable; but since then telegraphic wires have been better insulated, and the system is now becoming of great utility, as it nearly doubles the capacity for work of every wire. And yet within how short a period of time has all the wonderful progress in telegraphy been achieved. How incredulous the world a few years ago would have been if then told of the marvels which in so short a space of time were to be accomplished by its agency. I am acquainted with some who when the first Transatlantic cable was proposed, contributed towards that undertaking with the consciousness that it was only an experiment, and that subscribing to it was much the same thing as throwing their money into the sea. Much of this cable was lost in the first attempt to lay it; but its promoters, nothing daunted, made 900 miles more cable, and finally laid it successfully in the following year, 1858. The telegraphic system of the world comprises almost a complete girdle round the earth;

and it is probable that the missing link will be supplied by a cable between San Francisco, in California, and Yokohama, in Japan. How resolute and courageous those who engaged in submarine telegraphy have been will appear from the fact that, though we have now 50,000 miles of cable in use, to get at this result, nearly 70,000 miles were constructed and laid. Failure, in the opinion of Dr. C. W. Siemens (to whom I am much indebted for information on this subject), was partly due to the late introduction of testing a cable under water before it is laid, and to the use of too light iron sheathing. Of railways the progress has been enormous; but I do not know that in a scientific point of view a railway is so marvellous in its character as the electric telegraph. The results, however, of the construction and use of railways are more extensive and widespread, and their utility and convenience brought home to a large portion of mankind.

Sir John then entered into the history of the railway system, and fully considered the question of placing railways in the hands of the Government, as to which he remarks:—

"One thing they could, and perhaps would do. In cases where the traffic is varied, and could more safely be conducted with the aid of relief lines, which hold out no sufficient inducement to the companies to make, the government, being content with a lower rate of interest, might undertake to make them, though then comes the question whether, when the whole of this vast machine came to depend for supplies on annual votes of Parliament, money would be forthcoming in greater abundance than it is under the present system. But the consideration of this subject involves other and more difficult questions. Where are the labours of Government to stop? The cares of State which cannot be avoided are already heavy, and will grow heavier every year. Dockyard establishments are trifling to what the railway establishments, which already employ 250,000 men, would be. The assumption of all the railways would bring Government into conflict with every passenger, every trader, every merchant, and every manufacturer. With the railway companies there would be no difficulty; they would sell their undertakings to anyone provided the price was ample. Looking at the vast growth of railway traffic, one measure occurs to me as conducive to the safety of railway passengers, and likely to be demanded some day: it is to construct between important places railways which should carry passengers only or coals only, or to be set apart for some special separation of traffic; though there will be some difficulty in accomplishing this. Landowners through whose properties such lines would pass would probably wish to use such lines for general purposes. Nevertheless it may have to be tried some day. It would be instructive, were it practicable, to compare the relative proportion of accidents by railway and by the old stage coaches; but no records that I am aware of exist of the latter that would enable such a comparison to be made. It is practicable to make some sort of comparison between the accidents in the earlier days of our own railways and the accidents occurring at a later date. The Board of Trade have unfortunately abandoned the custom, which they have adopted from 1852 to 1859, of returning the passenger mileage, which is given in the German returns, and is the proper basis upon which to found the proportion of accidents, and not on the number of passengers without any regard to distance travelled, which has altered very much, the average journey per passenger being nearly half in 1873 what it was in 1816. It would be erroneous to compare the proportions of accidents to passengers carried in various years, even if the correct number of passengers travelling were given. But a figure is always omitted from the Board of Trade return, which makes the proportion of accidents to passengers appear larger than it is; this is the number of journeys performed by season ticket holders. Some estimate could be made of the journeys of season ticket holders by dividing the receipts by an estimated average fare, or the companies could make an approximate estimate, and the passenger mileage could be readily obtained by the railway companies from the tickets. These additions would greatly add to the value of the railway returns as statistical documents, and render the deductions made from them correct. Though it has been a work of labour, I have endeavoured to supply these deficiencies, and I believe the results arrived at may be taken as fairly accurate. From the figures so arrived at, it appears the passenger mileage has doubled between 1861 and 1873; and at the rate of increase between 1870 and 1873 it would become double what it was in 1873 in twelve years from that time, namely, in 1885. The number of passengers has doubled between 1864 and 1873, and at the rate of increase between 1870 and 1873 it would become double what it was in 1873 in 11½ years, or in 1885. It must, however, be remembered that the rate of increase since 1870, though very regular for 1871, 1872, and 1873, is greater than in previous years, being probably due to the rise of wages and the great development of third-class traffic, and it would not be safe to assume this rate of increase will continue. Supposing no improvement had been effected in the working of railway traffic, by the interlocking of points, the block system, &c., the increase of accidents should have borne some proportion to the passenger mileage, multiplied by the proportion between the train mileage and the length of line open, as the number of trains passing over the same line of rails would tend to multiply accidents in an increasing proportion, especially where the trains run at different speeds. The number of accidents varies considerably from year to year, but taking two averages of ten years each, it appears that the proportion of deaths of passengers from causes beyond their control to passenger miles travelled in the ten years ending December 31, 1873, was only two-thirds of the same proportion in the ten years ending December 31, 1861; the proportion of all accidents to passengers from causes beyond their own control was one-ninth more in the last ten years than in the earlier, whereas the frequency of trains had increased on the average one-fourth. The limit, however, of considerable improvements in signalling, increased brake power, &c., will probably be reached before long, and the increase of accidents will depend on the increase of traffic, together with the increased frequency of trains. The large growth of railway traffic, which we may assume will double in twenty years, will evidently greatly tax the resources of the railway companies; and unless the present companies increase the number of the lines of way, as some have commenced to do, or new railways are made, the system of expeditious and safe railway travelling will be imperilled. Up to the present time, however, the improvements in regulating the traffic appear to have kept pace with the increase of traffic and of speed, as the slight increase in the proportion of railway accidents to passenger miles is probably chiefly due to a larger number of trifling bruises being reported now than formerly.

Economy of fuel was dealt with thus:—

A pressing subject of the present time is the economy of fuel. Members of the British Association have not neglected this momentous question. At the meeting held at Newcastle-on-Tyne in 1863, Sir William Armstrong sounded an alarm as to the proximate exhaustion of our coal-fields. Mr. Bramwell, when presiding over the Mechanical Section at Brighton, drew attention to the waste of fuel. Dr. Siemens, in an able lecture he delivered by request of the association to the operative classes at the meeting at Bradford, pointed out the waste of fuel in special branches of the iron trade, to which he has devoted so much attention. He showed on that occasion that, in the ordinary reheating furnace, the coal consumed did not produce the twentieth part of its theoretical effect, and in melting steel in pots in the ordinary way not more than one-seventieth part; in melting one ton of steel in pots about 2½ tons of coke being consumed. Dr. Siemens further stated that, in his regenerative gas furnace, one ton of steel was melted with 12cwt. of small coal. Mr. Lowthian Bell, who combines chemical knowledge with the practical experience of an ironmaster, in his presidential address to the members of the Iron and Steel Institute in 1873, stated that, with the perfect mode of withdrawing and utilizing the gases and the improvement in the furnaces adopted in the Cleveland district, the present make of pig iron in Cleveland is produced with 3½ million tons of coal less than would have been needed 15 years ago; this being equivalent to a saving of 45 per cent. of the quantity formerly used. He shows by figures, with which he has favoured me, that the calorific power of waste gases from the furnaces is sufficient for raising all the steam and heating all the air the furnaces require. It has already been stated that by working steam more expansively, either in double or single engines, the consumption of fuel in improved modern engines, compared with the older forms, may be reduced to one-third. Mr. Lowthian Bell's figures go to show that in the interior of the blast furnace, as improved in Cleveland, there is not much more to be done in reducing the consumption of fuel; but much has already been done, and could the reductions now attainable, and all the information already acquired, be universally applied, the saving in fuel would be enormous. How many open blast-furnaces still belch forth flame, and gas, and smoke as uselessly, and with nearly as much mischief to the surrounding neighbourhood, as the fires of Etna or Vesuvius? How many of the older and more extravagant forms of steam engines still exist? What is to be done with the intractable householder, with the domestic hearth, where, without going to German stoves, but by using Galton's grates and other improvements, everything necessary both for comfort and convenience could be as well attained with a much smaller consumption of coal? If I have pointed out that we do not avail ourselves of more than a fractional part of the useful effects of fuel, it is not that I expect we shall all at once mend our ways in this respect. Many cases of waste arise from the existence of old and obselete machines, of bad forms of furnaces, of wasteful grates, existing in most dwelling-houses; and these are not to be remedied at once, for not every one can afford, however desirable it might be, to cast away the old and adopt the new. In looking uneasily at the future supply and cost of fuel, it is, however, something to know what may be done even with the application of our present knowledge; and could we apply it universally to-day, all that is necessary for trade and comfort could probably be as well provided for by one-half the present consumption of fuel; and it behoves those who are beginning to build new mills, new furnaces, new steamboats, or new houses, to act as though the price of coal which obtained two years ago had been the normal and not the abnormal price.

From economy of fuel the President passed to guns and engineering in regard to warfare:—

There was in early years a battle of the gauges, and there is now a contest about guns; but your time will not permit me to say much on their manufacture. Here again the progress made in a few years has been enormous; and in contributing to it two men, Sir William Armstrong and Sir Joseph Whitworth, both civil engineers in this country, at all events, deservedly stand foremost. The iron coil construction of Sir William Armstrong has already produced remarkable and satisfactory results. In discussing further possible improvements, the question is embarrassed by attempting to draw sharp lines between what is called steel and iron. There is nothing that I can see to limit the size of guns, except the tenacity and endurance of the metal, whatever we may choose to call it, of which they are to be made. Sir Joseph Whitworth, who has already done more than any other man in his department to secure good workmanship, and whose ideal of perfection is ever expanding, has long been seeking, and not without success, by enormous compression, to increase those qualities in what he calls homogeneous metal. Make the metal good enough, and call it iron if you will, and the size of a gun may be anything; the mere construction and handling of a gun of 100 tons, or of far greater weight, with suitable mechanical appliances, presents no difficulty. Relying on the qualities of his compressed metal, Sir Joseph is now seeking by a singular experiment to limit the travel of the recoil, as far as practicable, to the elasticity of the metal. By attaching the muzzle of the gun to an outer casing, through which the force of the recoil is carried back to the trunnions, he proposes to avail himself of this elasticity to the extent of one and a-half times the length of the gun; whether its elasticity alone in so short a space will suffice without other aid is, perhaps, doubtful; but other aid may be applied, and the experiment, whether successful or not, will be interesting.

Sir John concluded his address in the following impressive terms:—

"Whence and whither," is an aphorism which leads us away from present and plainer objects to those which are more distant and obscure; whether we look backwards or forwards, our vision is speedily arrested by an impenetrable veil. On the subjects I have chosen you will probably think I have travelled backwards far enough. I have dealt to some extent with the present. The retrospect, however, may be useful to show what great works were done in former ages. Some things have been better done than in those earlier times, but not all. In what we choose to call the ideal we do not surpass the ancients. Poets, and painters, and sculptors were as great in former times as now; so probably, were the mathematicians. In what depends on the accumulation of experience we ought to excel our forerunners. Engineering depends largely on experience; nevertheless, in future times, whenever difficulties shall arise, or works have to be accomplished for which there is no precedent, he who has to perform the duty may step forth from any of the walks of life, as engineers have not unfrequently hitherto done. The marvellous progress of the last two generations should make every one cautious of predicting the future. Of engineering works, however, it may be said that their practicability or impracticability is often determined by other elements than the inherent difficulty in the works themselves. Greater works than any yet achieved remain to be accomplished—not, perhaps, yet awhile. Society may not yet require them; the world could not at present afford to pay for them. The progress of engineering works, if we consider it, and the expenditure upon them, has already in our time been prodigious. One hundred and sixty thousand miles of railway alone, put into figures at £20,000 a mile, amounts to £3,200,000 sterling; and 400,000 miles of telegraph at £100 a mile, and 100 millions more for sea canals, docks, harbours, water and sanitary works constructed in the same period, and we get the enormous sum of £3,340,000 sterling expended in one generation and a half on what may undoubtedly be called useful works. The wealth of nations may be impaired by expenditure on luxuries and war; it cannot be diminished by expenditure on works like these. As to the future, we know we cannot create a force; we can, and no doubt shall, greatly improve the application of those with which we are acquainted. What are called inventions can do no more than this, yet how much every day is being done by new machines and instruments. The telescope extended our vision to distant worlds. The spectroscope has far outstripped that instrument, by extending our powers of analysis to regions as remote. Postal deliveries were and are great and able organisations, but what are they to the telegraph? Need we try to extend our vision into futurity further? Our present knowledge, compared to what is unknown even in physics, is infinitesimal. We may never discover a new force—yet who can tell?

It is scarcely necessary to say that the President's address was received with much applause.

The sections have been arranged as follows:—

A.—Mathematical & Physical Science.—President, Professor Balfour Stewart, M.A., LL.D., F.R.S.; Vice Presidents, Rev. J. W. Caldicott, D.D., Professor H. J. S. Smith, M.A., F.R.S., F.C.S.; Secretaries, Professor W. F. Barrett, F.R.S.E., M.R.I.A., F.C.S.; J. W. L. Glaisher, M.A., F.R.S., F.R.A.S.; C. T. Hudson, M.A., LL.D; G. F. Rodwell, F.R.A.S., F.C.S.

B.—Chemical Science.—President, A. G. Vernon Harcourt, M.A., F.R.S., F.C.S.; Vice President, Dr. Debus, F.R.S., F.C.S., Secretaries, Dr. H. E. Armstrong, F.C.S., W. Chandler Roberts, F.R.S.; W. A. Tilden, D.Sc., F.C.S.

C.—Geology.—President, Dr. T. Wright, F.R.S.E., F.G.S.; Vice Presidents, R. Etheridge, F.R.S.L. and E, F.G.S., Sir W. V. Guise, Bart., F.G.S., F.L.S.; Secretaries, L. C. Miall, F.G.S., E. B. Tawney, F.G.S., W. Topley, F.G.S.

D.—Biology.—Presidents, P. L. Sclater, M.A., Ph. D., F.R.S.; Vice Presidents, Professor Cleland, M.D., F.R.S., Professor Rolleston, M.A., M.D., F.R.S., F.L.S.; Secretaries, E. R. Alston, Professor W. R. M'Nab, M.D., F. W. Rudler, F.G.S., Dr. P. H. Pye-Smith, Dr. W. Spencer, F.L.S.

Department of Zoology and Botany.—P. L. Sclater, M.A., Ph.D., F.R.S., F.L.S. (president) will preside; Secretaries, E. R. Alston, Professor W. R. M'Nab, M.D.

Department of Anatomy and Physiology.—Professor Cleland, M.D., F.R.S. (Vice President), will preside; Secretaries, Dr. P. H. Pye-Smith, Dr. W. Spencer, F.L.S.

Department of Anthropology.—Professor Rolleston, M.A., M.D., F.R.S., F.L.S. (Vice President), will preside; Secretary, F. W. Rudler, F.G.S.

E.—Geography.—Presidents, Major General Strachey, R.E., C.S.I., F.R.S., F.R.G.S., F.L.S., F.G.S.; Vice-President, Sir J. F. Davis, Bart., K.C.B., F.R.S., F.R.G.S.; Secretaries, H. W. Bates, F.L.S., Assist. Sec. R.G.S.; E. C. Rye, F.Z.S., Librarian R.G.S.; F. F. Tuckett.

F.—Economic Science and Statistics.—President, James Heywood, F.R.S., Pres. S.S.; Vice-Presidents, Dr. Beddoe, F.R.S., Rev. J. Percival, M.A., LL.D.; Secretaries, E.P. Fellows, F.S.A., F.S.S., T. G. P. Hallett, M.A., E.M. Macrory, M.A.

G.—Mechanical Science.—President, William Froude, C.E., F.R.S.; Vice Presidents, F. J. Bramwell, C.E., F.R.S., C. W. Merrifield, F.R.S., C. W. Siemens, D.C.L., F.R.S., F.C.S., M.I.C.E.; Secretaries, W. R. Browne, M.A, H. M. Brunel, J. G. Gamble, B.A., J. N. Shoolbred, C.E., F.G.S.

Besides these meetings, most of which it is anticipated, will this year present points of unusual interest, there are to be discourses by Dr. Spottiswoode on the "Colours of Polarised Light," and by Mr. Bramwell, on "Railway Safety Appliances," a lecture to the working classes by Dr. W. B. Carpenter, on "A Piece of Limestone;" and a *soirée* and complimentary concert by the gentlemen of the Orpheus Glee Club.

The excursions are numerous and attractive; but the arrangements at present somewhat incomplete.

Geography.—In this section the president, General Strachey, R.E., F.R.S., delivered an address which attracted a good deal of attention. He remarked that the course of the Challenger and the Arctic Expedition were proofs that expeditions were now directed towards general scientific research, rather than topographical discovery. This was due to the fact that but a small portion of the earth's surface remained unexplored. The tendency now was to make expeditions more scientific than formerly, and the general progress of science would make this principle still more important. He should not deal with the origin of matter, because in their present state of knowledge such subjects were not legitimate fields for physical science. The law of evolution applied to geography led up to the conclusion that the existing outlines of the sea and land had been caused by the modification of pre-existing oceans and continents brought about by influences still in operation; and that the distribution of life on the surface of the earth as they now found it was the result of successive changes by the necessary action of the matter out of which it had been formed. No matter how far they pushed back their enquiries they seemed to be unable to reach an epoch in which were to be found indications of the source of life. The substances of which the earth was now composed were the same as those of which it was always composed. It was now established that man existed on the earth at a time long anterior to the period of which they had any records in history or otherwise. The ancient monuments of Egypt took them back 7,000 years, and showed that the adjacent countries were as far advanced in civilisation as they were 1,500 years ago. As far as they could see back man stood in the front of the animal kingdom, occupying a pre-eminence then as he did now. By each advance of civilisation power was acquired, and man by stages advanced to the position in which he now stood. In his struggles, however, to advance man differed in scarcely a single particular from all the other creatures at his feet. All were bound up by a common law, each depending on the other, and all borne forward by the earth, which was continually subject to the laws of change.

Professor Rawlinson moved a vote of thanks to the President for his address, which he said would furnish them with materials for reflection during the ensuing year.

Mr. Bates, one of the secretaries, read a report on the Palestine Exploration Fund, to which the association last year had voted £100. It had been decided to withdraw Lieutenant Conder and his party in consequence of the attack which had been made upon them and the prevalence of the cholera.

Canon Tristram said that, although the attack on Lieutenant Conder's party was a very sad end to an important work, it would be useful to Lieutenant Conder, and enable him to recruit his health, he having, in his zeal, refused to come away when the state of his health imperatively demanded it. It must not be thought that the country was unsafe, as the attack had really arisen from an isolated fanatical outbreak.

The report was adopted.

Economic Science and Statistics.—This section was composed more than three-parts of ladies, amongst whom were Miss Becker, Mrs. Bohn, Miss Bryant, Miss Chambers, Mrs. Crawshay, Miss Carpenter, Mrs. Gray, Mrs. E. M. King, Miss Orpen, &c.

Mr. James Heywood, M.A., F.R.S., F.G.S., delivered the opening address.

Sir Willoughby Jones moved a vote of thanks to the chairman, and Dr. Farr seconded the motion, which was carried by acclamation.

Mr. W. Stanley Jevons, Professor of Political Economy of Owen's College, Manchester, then read a paper on "The Progress of the Coal Question." This subject was of special importance just now, as the result of the boring in the weald of Sussex had shown that there was no hope of getting coal at any moderate depth in that part of the country. In 1873 the total produce was estimated at 127,000,000 tons. They would all remember the alarm created by the statement of Sir W. Armstrong in 1863, at the meeting of this association, that taking the annual increase at 2¾ million tons per annum, and assuming that that rate of increase would continue, the coal supply of Britain would last only 212 years. He (Professor Jevons) had investigated the statistics of the subject in order to see if Sir William's rate of increase had been realised. Supposing that in 1861 the produce was 86 millions, it would now be, with a rate of increase at 2¾ millions per annum, 100 millions; but the fact was it amounted to 127 millions, so that Sir W. Armstrong's calculation was less than the truth by 18 millions. The fact was that Sir William's rule of calculation, that of arithmetical progression, was unsound, as if reckoned backwards, it would bring the coal supply to zero in the year 1830. The true rule was that of a goemetric increase of three and a half per cent., and that produced results still more alarming than those predicted by Sir William. The recent coal famine might be taken as the first fringe of the scarcity which must come sooner or later. That famine, he believed, arose chiefly from increased demand. No doubt the colliers took advantage of high prices to lesson the hours of labour; and the Mines Regulation Act of 1872 coming in opportunely into force also tended in that direction. There could, however, be no doubt that coal would never again be so cheap in this country as it was from 1864 to 1871. Although up to the present time the increase of consumption had been according to geometric progression, it was obvious that it could not always go on at that rate (cheers). The remainder of his paper was a defence of his own statements against the attacks which had been made upon them by Mr. Hunt and Mr. Hull.

Sir James Alexander asked what was the opinion of Professor Jevons as to whether exportation of coal should be allowed.

Mr. Sopwith suggested that although the extend of the coal fields might be correctly calculated, sufficient allowance was not made for the amount of mineral that was lost in the getting, and must remain for ever in the bowels of the earth.

Mr. F. P. Fellows said that no doubt a time would come when we must cease to export, and when we should be obliged to import coal. It was a most important question; for the moment we had to import coal our manufactures would decrease and our national prosperity vanish. The rise in price in 1872 and 1873 had had at least one good effect. It had led to greater economy, and the coal now produced did very much more work than it did before. With the view of fostering and compelling economy he advocated the proposal made by Sir Rowland Hill at the Statistical Society, namely, to tax coal. That proposal, it must be remembered, included also the idea of taking off an equivalent amount of taxation from other articles of daily consumption.

Mr. Bennock said the waste of coal going on all around them was a disgrace to the genius of the country and the scientific knowledge of the age. Everything should be done to economise fuel, but when the need came something else besides coal would be found to give to man heat, light, and power. The forests of Sussex were consumed in smelting the iron found in that locality, and when they were all gone coal was discovered, and Sussex smelting ceased for ever.

Dr. Farr said the plain fact was that our consumption of coal doubled every 20 years. If he had been at the Statistical Society he should have supported Sir R. Hill's proposition, although it was unpopular with all who used coal.

Professor Tennant said that the reports furnished by her Majesty's inspectors of mines put the amount of produce in 1873 at 121,680,130 tons, and not 127 millions, as stated by Professor Jevons.

Mr. Leone Levi did not think it would be possible, and it certainly would not be advisable, to stop the exportation of coal. A large portion of that export went to our colonies to be used very often by our own steamers in all parts of the world.

Mr. E. M. King asked whether Professor Jevons had made any calculation as to the proportion consumed in manufactures and in household purposes, and whether the latter was not so small in comparison as to make household economy a matter of little moment.

Professor Jevons had no exact figures, but it had been calculated that house consumption was one ton per head per annum of the whole population—that was from 30 to 40 millions of tons, or a fourth of the whole consumption. No doubt something might be saved in household fuel, but the amount would be too small to make any impression on such a vast total. With regard to the export of coal, it only amounted to 12 or 14 millions of tons per annum—an amount really not worth talking about. He had always been opposed to a tax on coal; but having read Sir Rowland Hill's reasons for it he thought it was a question which required careful and deliberate study before it was rejected.

The discussion then terminated.

THE SOCIAL SCIENCE CONGRESS.

We direct attention to the Fourth Exhibition of Sanitary, Educational, and Domestic Appliances in connection with the Congress of the National Association for the Promotion of Social Science, which will take place from the 6th of October to the 16th, in the Corn Exchange, adjoining the dome of the Pavilion, Brighton.

The object of the exhibition, as heretofore, is to bring under the notice of the public generally, and particularly those who are interested in social, sanitary, educational, and economical questions, the latest scientific appliances for improving the public health, promoting education, and advancing social economy. These will be classified under the following heads, viz.:— 1. Warming, Ventilation, and Lighting. 2. Domestic Appliances and Economic Apparatus. 3. Sanitary Architecture and Appliances. 4. Sanitary Engineering and Methods of Disinfecting. 5. Food and Clothing. 6. School Furniture and Educational Apparatus.

Mr. James Robinson is secretary to the committee, which has its *locale* at 1, Adam-street, Adelphi, London.

THE ESTABLISHMENT OF THE BRITISH MUSEUM.

WE extract the following from the *Athenæum*, as we think an account of this great national institution, which is of so much importance to scientific as well as general literature, is well worthy of attention :—

A document has lately appeared, entitled "List of the Trustees," &c., of the British Museum, and giving details of the official standing, salary, and date of appointment of each person belonging to the staff of the great reservoir of learning in Bloomsbury. It is an extremely curious publication, and even superficial study reveals one of the sources of that bitterness and profound discontent which makes the Museum a sort of cage, containing what is by no means a "happy family." The staff is much more numerous than folks suppose, for its muster-roll is equal to that of an English cavalry regiment, say a little over three hundred men. The office of the principal librarian and secretary comprises that distinguished gentleman,—for Mr. Winter Jones is both in one,—with £1,200 a year salary, an assistant secretary, and an accountant. With these officials are four senior assistants, five junior assistants and an attendant. One of the senior assistants gets £80 a year additional to his proper £400 for acting as private secretary to Mr. Winter Jones, who also has an assistant secretary besides, at £500 per annum. The salaries of the officers in this department range from the above to the £100 per annum of Mr. C. E. Fagan. The department of Printed Books, lately headed by Mr. Rye (appointed June, 1838), at £600 a year, comprises Messrs. Bullen, Porter, and Roy (January, '38, March, '46, April, '41), at £450 each. Also eight senior assistants, Upper Section, comprising Messrs. Garnett ('51), R. Martineau ('57), Dr. Haas ('66); senior assistants, Lower Section, twenty in all, with salaries ranging from £340 to £200, and appointments dating from 1835 to 1873. The positions of Mr. Bullen and Mr. Garnett have been lately altered by the retirement of Mr. Rye. There appears to be no connexion between the amounts of the salaries and the dates of the appointments in the British Museum. According to this "list," Mr. Louis Alexander Fagan, recently chosen to act as Assistant Keeper in the Print Room, dates from September, 1869; in January, 1870, he became Senior Assistant, Lower Section; as such he now receives £215 per annum; in February last an extra £100 is bestowed, thus making his income £315., while Mr. George Smith, of "Nineveh," gets £215 on an appointment officially equal to, and nearly coeval to, that of Mr. Fagan. Mr. Major, the able keeper of maps, who entered the Museum in 1844, had, when the Report appeared, only £500 a year; Mr. H. Woodward, £400; Mr. R. Martineau, although he has been nearly twenty years in the public service, £380; Mr. Maskelyne, keeper of Minerals (1857), has £500; Mr. Carruthers (1859), the same; Dr. Birch (1836), the same; Mr. C. T. Newton (1861), £600; Mr. B. V. Head, assistant keeper of coins, (1864), £450; Mr. Reid, keeper of prints, (1866), £500, and, stranger than all, Mr. Fagan's appointment of 1869 is two years younger than that of his colleague in the same department, Mr. F. M. Donoghue, who has only £170 a year, or not much more than half the pay of his junior in office, who has been put over his head.

There are fifteen junior assistants, thirty first-class attendants, and twenty-four second-class attendants in the department of Printed Books, at, as to the first category, salaries ranging from £180 to £100, and services dating from 1849 to 1873; of the second category, the salaries range from £120 to £115; the third category comprises men paid from £100 to £60 a year, and services dating from 1860 to 1874. The Map department consists of a keeper, two assistants, and three attendants. The department of MSS. is managed by a keeper proper, Mr. Bond (1838); the keeper of Oriental MSS., Mr. Rieu (1847); an assistant keeper, and three senior assistants, Upper Section, including Mr. Ward (1849) at £400: thus, after twenty-six years' service, he obtains £75 per annum more than Mr. L. A. Fagan, of one-fifth of that period. Also senior assistants, Lower Section, including Mr. R. Sims at £225 (1841), a junior assistant, five first-class attendants, and seven of the second-class. The reading-room service is performed by five first-class and nine second-class attendants.

The departments of Natural History are managed by Prof. Owen, superintendent, £800 (1856); Mr. O'Shaughnessy, £245 (1861); Dr. Günther, keeper of Zoological department, £600 (1862); an assistant keeper, £450; three senior and two junior assistants, five first-class and six second-class attendants. The Geological department has a keeper, £600 (1843); a senior assistant, £400 (1858); a junior assistant, £120 (1872); three first and three second-class attendants. The Mineralogical department has a keeper, £500 (1857); a senior and a junior assistant,—the latter entered the Museum in 1858, and receives £180, after eighteen years' service—here is a lucky "officer"!—two second-class attendants. The Botanical department has a keeper at £500 (1859), two senior assistants, one first-class and two second-class attendants.

The department of Oriental Antiquities is led by Dr. Birch, with Mr. G. Smith as his assistant. The department of Greek and Roman antiquities is similarly furnished with Mr. C. T. Newton and Mr. A. S. Murray. The department of Coins has a keeper, an assistant keeper, and four assistants, including Mr. Ffister, who entered the service a quarter of a century since, and has attained to £400 a year. The department of British Antiquities has a keeper, Mr. A. W. Franks, £600 (1851), and one junior assistant. The four departments of Antiquities divide the services of eight first-class and twenty second-class attendants.

The department of Prints comprises a keeper, a senior assistant, Mr. L. A. Fagan, who is also acting assistant keeper, a junior assistant, one first-class and two second-class attendants.

Besides these, the staff of the "House" consists of a messenger and an assistant messenger (these are probably the resplendent personages whom one encounters in the hall); two second-class attendants, a chief fireman, three firemen, a locksmith, a plumber, a glazier, seven gatekeepers and watchmen, three ladies' attendants, who lie *perdu* somewhere, four housemaids, twenty labourers, five window cleaners, two newspaper boy sorters, (so called) yet surely the title is a strange one, as it infers that Mr. Winter Jones has a collection of newspaper boys, the elements of which the said gentlemen are engaged in "sorting."

The staff of the Museum concludes with a clerk of the works, a time-keeper, an inspector of police, a sergeant and twelve constables, a superintendent of fire-engines, a superintendent of warming and ventilation, his assistant, foreman, and six stokers. All told, the staff consists of three hundred and twenty-six individuals.

REGAN'S IMPROVED BOILER.

THE first part of these improvements has reference to an improved arrangement of steam boilers, both for marine and land purposes. The first form is constructed of three cylinders, standing verticle, the one being placed within the other at suitable distances apart, and constituting the water spaces; the same being constructed sufficiently large to enable a man to fix the tubes which pass into the centre cylinder, both ends of which are egg ended, the top having a manhole, the lower end next to furnace being connected to a wrought iron conical down pipe, which passes down the centre of the furnace grate. By means of a circular flange attached to this pipe, suitably constructed, supports the furnace at centre, either as fixed or for rotary motion.

Attached to the end of the conical down pipe is a four way branch, which is connected to the outer water space, next to the large cylinder; by this means a free circulation of the water is effected.

Immediately under the centre junction a blow-off pipe, with cock, is connected, consequently an effective and thorough cleansing of the water spaces is obtained.

The centre egg ended cylinder is connected to the intermediate cylinder by means of tubes, placed at suitable distances apart, and at an incline sufficient to allow free circulation of the water to pass upwards. The tubes are placed zigzag, one tier above the other, and continued to the top of the intermediate and centre cylinders.

The chimney is connected to the intermediate cylinder, and passes upwards through the outer cylinder. The heat from the furnace passes upwards and around the tubes, impinging on the surface of each tube, as also on the surface of the boiler plates, in which the tubes are inserted, thus rapidly generating steam; and the heat passing upwards through a steam dome, superheats the steam. The furnace bars may be stationary or rotary.

A second boiler is constructed of one large cylinder, in which the tubes and furnace are fixed. By means of this improvement, one tier of parallel tubes is placed immediately above the furnace in a zigzag position, thus: $_{o}{}^{o}{}_{o}$, slightly inclined for the better circulation of the water.

I recommend my transverse jozzle grate bar furnace for this boiler, with smoke consuming self-acting door. The travelling machine furnace can also be applied with great advantage in this boiler. Superheating tubing is fixed in the steam dome.

My improved transverse joggle grate bar furnace is constructed of two side bearers placed longitudinally at the sides of the furnaces for carrying the bars. The improvement in this furnace is that for each bar a semicircular seat is formed, properly spaced for each bar to drop into. The under part of the bar at both ends is circular. There is a rack which passes up the centre close under the bars, occasionally worked by a hand lever, applied to a bell crank; motion is given to joggle the bars by this means. All the burned refuse is removed into the ash-pit; the space between the bars is kept clear, which is so necessary for the free admission of air through the burning fuel; considerable saving in fuel is obtained, as also more steam generated.

Another most important object is gained, viz., the duration of the bars under the action of the heat. The bridge is constructed to carry one end of the side bearers and rack. The dead plate has brackets to support the other end of side bearers and rack; also the pedestals to carry the bell-crank. This dead plate is firmly bolted to the front of the furnace, which is fixed to the boiler. This simple arrangement carries all parts of the furnace without a bolt being required in the flue or furnace. Attached to the bridge is an air chamber, which is protected by a bridge plate; this plate forms part of top of the bridge for carrying the brick work. Air is admitted into this chamber by means of a valve and rod. The bars I recommend should be chilled bars, for durability against the heat.

In furnaces for the manufacture of iron and other purposes similarly constructed to the front castings at end of furnace a long plate of iron is fixed in slides, in which it is moved by means of a hand lever, operated on by the stoker when air is required to cause more perfect combustion in the furnace. In order to supply the air in a heated state, a chamber is provided between the plate and the brick work that forms the end of the furnace. The air is admitted into the lower part of the chamber, and passes upwards between the red brick work, which is introduced through the chamber; these bricks are placed at suitable distances apart to cause the air in its inward course to be considerably heated before coming in contact with the gasses. By this means more perfect combustion is obtained, and all the heating properties of the fuel developed to the highest point; consequently increased heat and more equal distribution over the surface of the furnace. By this invention a considerable saving in fuel and labour, increased quantities of work, and of improved quality in the manufacturing of the iron in all its stages, together with the total consumption of smoke are the results.

In my endless-chain grate bar self-feeding mechanical furnace, the frame work is constructed of two longitudinal side frames, coupled together at back with a casting suitable to the flue, in which it is fixed. At front end they are framed by means of a cross plate, firmly bolted to the ends, which is supported by two upright pillars. On the side frames in front of boiler, are fixed two plates, one on each frame, of sufficient height to contain the small coal for feeding the furnace. These plates are flanged at boiler, and bolted to it. The driving shaft is fixed in steps slightly tapered and chilled, the driving teeth are steel, and formed to the circular shape of the end of the chain bar; the pins for connecting the chain grate bar are also made of steel slightly tapered. On the end of the driving shaft is placed a worm wheel which gives motion to the furnace by means of any convenient motive power which is communicated by means of a belt. A most efficient means is supplied for regulating the proper strain of the chain grate. To the steps that support the driving shaft is fixed screws, which passes through the end plate. At back end of frames a roller is also fixed in conical chilled bearings, and directly over this roller across the grate is fixed a water bridge at a suitable distance to allow the burned refuse to drop into the ash pit; by their construction the bars free themselves of all the burned refuse when passing round the roller at back and also at front driving shaft. By this operation the grate is perfectly free from all burned refuse and clinkers as it passes in carrying its fresh supply of fuel, the air space between the bars being clear.

JOHNSON AND ALLAN'S PATENT APPARATUS FOR HEATING FEED-WATER, AND CONDENSING SURPLUS STEAM IN MARINE BOILERS.

MANY years' experience of marine boilers, under various conditions, has led the inventors of this apparatus to devise the means by which all the evils at present operating so seriously to shorten the life and decrease the efficiency of the marine boiler may be obviated. These evils are:—The rapid destruction of the boiler by the unequal contraction of the plates, caused by pumping cold watar into the boiler when steam is up, and the main engines at rest; the salting up of the boilers by blowing off steam representing a proportionate quantity of fresh water, which must be replaced by an equal quantity from the sea; the waste of heat (steam that is blown off being of a high temperature); and priming, which is frequently the result of the use of cold feed-water. The annoyance caused by blowing off surplus steam, which is particularly felt in war ships, passenger boats, and yachts, is entirely removed.

The apparatus is simple, and can be as easily fitted to an old as to a new boiler.

It consists of a number of tinned copper tubes, hung in the steam space from the top of the boiler, the upper end connected with a cast iron chest, and the lower with a three-way cock, both chest and cock being outside the boiler. The chest is connected with the main engine feed-pump, and with the steam or donkey-pump. The three way cock opens to an out-board discharge pipe, and to an inlet pipe to the boilers; it can be set to open partially to both, but can never be wholly closed to the pump.

Suitable check-valves are provided in the cast-iron chest, to prevent the return of water upon the pumps; also where the pipe enters the boiler at the top, and where the connection from the three-way cock enters the boiler at the bottom, this being the feed water inlet. A small relief valve is placed on the chest, to prevent any excessive pressure in the pipes. During the ordinary working of the engines the feed from the engine feed-pump enters the cast-iron chest, from thence passes through the upper check-valve into the series of pipes within the boilers, and through these to the three-way cock, which is set so as to allow it to pass through the lower check-valve into the boilers. When the main engine is at rest the three-way cock is set to prevent the water entering the boilers through the lower check-valve, and to allow it to pass overboard, the steam pump is put in motion, and the cold salt water passes through the series of tubes, which then present cooling surface of sufficient area to condense the steam that would otherwise have to be blown off through the safety-valves; the steam therefore falls back into the water space as fresh water. No more heat is transferred to the water within the tubes than is just requisite to prevent the steam blowing off. The small quantity of water evaporated to form the steam used by the steam pump can be replaced by turning a portion of the out-board discharge into the boilers through the lower check-valve by means of the three-way cock. The water-level can thus be maintained by the introduction of a minimum of salt water into the boilers, and the great destruction caused by a cold feed is entirely obviated, since the water is heated before entering the boilers.

From this description it will be evident that the engineer has a hot feed always at command, can greatly check the deposit of salt in the boilers, and need never allow the steam to blow off; the only additional duty devolving upon him is the moving of the three-way cock—the remainder of the apparatus being entirely self-acting.

The several advantages described can be obtained by a moderate first outlay, and must necessarily effect a great saving in the working of steam ships where leaky boilers, deposit of salt, waste of steam, priming, &c., are always more or less the cause of undue consumption of coal, expensive repairs, rapid deterioration of the boilers, and long passages of the ships.

BAXTER'S PATENT IMPLEMENT FOR SLAUGHTERING OXEN, HORSES, AND OTHER ANIMALS.

THE necessity of an improved method of slaughtering oxen has long been admitted; the Royal Society for the Prevention of Cruelty to Animals recognising this necessity at its Jubilee Congress, held at the rooms of the Society of Arts, in June, 1874, when the secretary, Mr. Colam, said:—"He would not recommend them to support by resolution any particular method, but to agree to any plan which included the blinding of animals and certainty of aim."

At the same meeting Herr Sondermann moved the following resolution, which was carried:—

"That the best method of slaughtering animals, as far as our knowledge extends at present, consists in the production of complete insensibility by shattering or concussion of the brain; after which death is brought about by bleeding. In the case of larger animals, this Congress is of opinion that before the process of slaughtering be commenced, the animal's eyes should be covered, and that no implement be considered satisfactory unless it can be used with certainty of aim." (See *Daily News*, June 19th, 1874.)

To meet the requirements set forth in the above resolution, the inventor humbly submits this implement to the notice of the Royal Society for the Prevention of Cruelty to Animals, to slaughtermen, butchers, and all interested in securing a speedy, effectual, and humane method of slaughtering beasts.

It can be adapted to use on the forehead or poll, whichever system may be deemed most humane (in either case the eyes being effectually covered). It has been practically tested by continual use from August last to the present time in the slaughterhouse of a butcher of great experience near London, who found that it places within the reach of any one using it all the advantages claimed, viz.:—

1st. Facility of adjustment. 2ndly. Effectual covering of the eyes. 3rdly. Certainty of aim. 4thly. Production of complete insensibility. 5thly. Simplicity of construction.

The inventor and patentee is Mr. Robert Baxter, of Ealing Dean, near London.

THOMAS AND NICHOLSON'S IMPROVED SHIP'S ANCHOR.

THIS anchor shows several practical deviations from any form of anchor now in use, which may be briefly described as follows:—

Primarily it is made either solid or portable, and when made portable the head of the shank is connected to the crown by two strong taper copper bolts or pins fitted into holes bored conically through the parts. The advantage of thus connecting is found in the increased facilities for disconnecting after service, preventing as it does the vexatious driving and drifting almost inevitable where the usual single parallel bolt is used.

The palms are convex-faced and elongated, so that while they prevent the cable from fouling are also found to be the best form to ensure the "pea" entering hard ground on impact; and they also yield great holding power.

To complete the anchor the stock is simply passed through the shackle end of the shank, and keyed against the washer or collar welded on the reverse side of the shank eye.

The anchor is made thin on its edge and broad on its flat to give additional strength in the way of strain, and when disconnected is in three main parts—crown, shank, and stock, and is very light for weight.

COMMISSIONERS OF PATENTS' ANNUAL REPORT.

THE appearance of this Report has caused some of our contemporaries to direct attention to the state of our Government Patent Office, and its operations, the *Daily News* especially treating the subject in the following manner:—

"The Patent Laws remain unamended notwithstanding the promise that the subject should be dealt with. Through the Lords indeed, the Bill for the purpose passed smoothly enough; but, on appearing in the Commons, it excited so strong and general an opposition that it was not even allowed to be submitted to the test of discussion. The Report of the Commissioners was expected with considerable interest; but it disappoints the hopes of those who looked to it for hints or suggested changes which might supersede discussion. It repeats the old and worn-out story about the plot of ground on the Thames Embankment, but gives no summary of the many documents filed at the office during the past year, and which would, properly handled, supply material for a year's history of the progress of invention and mechanical improvement.

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F. W. Campin, Sec.

Proceedings of the Institute.

The Executive Committee was, in accordance with the new rules, summoned to meet on 26th ult.; but there being no special business to transact, the time was occupied by the general consideration of the Parliamentary work effected by the Institute during the past session in regard to the late Patent Bill; and in view of the introduction by the Government next Session of a measure based upon that Bill, it was suggested that Mr. A. J. Murray and other gentlemen taking an active interest in patent law reform, should place on paper detailed statements of their views as to the amendment of that law so as to lay them before the Executive on a future occasion.

Monthly Notices.

The Government Scientific Expedition.—A third report of the proceedings of H.M.S. Challenger has been promulgated by the Admiralty.

Lieut. Conder had fever after the attack upon him near the sea of Galilee which has been reported in the daily papers, but he is now quite well.

The Discovery of Anæsthesia.—A bronze statue is about to be erected at Harford, Connecticut, in memory of Dr. Horace Wells, as "discoverer of anæsthesia."

From Zanzibar, Mr. Alfred Bellville writes that Cameron is reported to have been seen by an Arab west of the Lualaba. Mr. Stanley is stated to have lost 100 men in a fight.

Prof. Max Muller's "Lectures on the Science of Language" has just been the subject of a new edition (8th.) A volume of Essays "On the Science of Language," by the same, is in the press.

The American Association for the Advancement of Science will hold its next meeting at Detroit, Michigan, commencing on Wednesday, the 11th of August, under the presidency of Mr. J. E. Hilgard, of the Coast Survey.

The Magnetic Equator was found by M. Janssen, during his recent visit to Siam, to pass between Ligor and Singora, the inclination being there reduced to zero; and he was also able to find a line of no-variation, in a different position from that previously laid down.

Undulations of Liquids in Circular Troughs are, Prof. Guthrie writes to the *Athenæum*, correctly stated to vary in rate inversely with the square root of the diameter (or radius). This is not all. The slowest undulations in a circular trough are isochronous with those of a pendulum, whose length is the radius of the circle of the trough.

Compressed Air as Anti-putrescent is, from some experiments recently described before the French Academy of Sciences by M. Bert, said to be demonstrated. In oxygen of high tension, organic matter may be preserved for a considerable time; and meat has been found fresh after keeping it for a month in oxygen at a pressure corresponding to 44 atmospheres. This arrest of decomposition is due, according to M. Bert, to the effect of the compressed oxygen in destroying any organisms that may be developed.

The Invasion of the Lake District by Factories has caused, says the *Athenæum*, a petition to the House of Commons to be prepared. It states that this district is publicly used for relaxation of mind and body by thousands of the public, and that it is expedient to preserve it from all encroachment that may tend to destroy its natural beauty, or open the way to such destruction. The exordium or circular accompanying this document states that, what with railways, coal, iron, and chemical works, great tracts of country have been rendered frightful, and the multiplication of smoking erections will make it worse. Unless we are prepared to turn the country into a smoke-darkened shop, some check must, sooner or later, be put on this process. An example of new danger, and of need for check, occurs in the Lake District, Ambleside being threatened.

The Decrease of Water in Rivers, Streams, and Springs has been taken up as a question for consideration by the Imperial Academy of Sciences at Vienna. A circular, accompanied by an able and instructive report, has been addressed to scientific societies in other countries, in the hope that they may be persuaded to undertake observations which, in course of time, may furnish data for practical use. The Academy calls attention to the fact that for some years past a diminution of the waters of the Danube and other great rivers has been noticed, and especially since the modern practice of cutting down forests without regard to consequences has prevailed. The Austrian Engineers and Architects' Union have also taken the question in hand, and appointed a "Hydrotechnic Committee" to collect facts and prepare a report. The Danube, the Elbe, and the Rhine, were each assigned to two members, while other two were to examine into the meteorology of the subject, and into the influence which glaciers and Alpine torrents may have on the general result. The Committee regard the question as urgent; they recommend the immediate adoption of remedial measures, and they are unanimous in declaring that the prime cause of the injurious decrease of water is the devastation of forests. It cannot be too strongly impressed upon all in the United Kingdom that the system of injudicious drainage of agricultural districts has seriously interfered with the natural condition of all our rivers.

The Decease of Mr. W. S. Williams, many years literary member of the staff of Smith, Elder, and Co., the eminent publishers, is announced at the age of 75.

Captain Webb swam across from Dover to Calais during the past month, in accordance with his undertaking so to do. He was fully 22 hours in the water.

Messrs. Griffith and Farran will shortly publish, in a collected form, a series of papers by Mr. Frank Ives Scudamore, of the Postal Telegraphs, which were contributed to the *Standard* newspaper under the *nom de plume* of "The Sleepless Man."

At the Social Science Congress, to be held at Brighton, Sir Edward S. Creasy, Chief Justice of Ceylon, has undertaken the Chairmanship of the International Law Section, and Lieut.-Col. Du Cane, C.B., R.E., Chairman of the Board of Directors of Convict Prisons, that of the Repression of Crime Section.

Walker's Statistical Atlas of the United States, compiled under authority of Congress, contains, in the first part, which relates to the "Physical Features of the United States," a series of ten maps; one of these, a map of the river systems, is the best yet published to illustrate the drainage areas; there are also two excellent geological maps, and five relating to climate.

The Marquis of Lorne has, says the *Athenæum*, written and placed in the hands of Messrs. Macmillan and Co., for publication, a narrative poem, entitled "Guido and Lita: a Tale of the Riviera." The subject of the poem, which contains about 3,000 lines, is taken from an incident in one of the Saracen raids on the coast of the Riviera during the tenth century. It will be illustrated by a frontispiece and vignette, and may be expected in the autumn.

Messrs. Macmillan and Co., have in preparation a Library Edition, in 3 vols. 8vo., of Mr. J. R. Green's "Short History of the English People." Substantially the same as the present book, it will have undergone thorough revision and considerable extension. The author, having more space at his command, has been enabled to treat more fully the history of the eighteenth and nineteenth centuries, which was unavoidably curtailed in the present edition. The publishers promise its appearance in the autumn.

The Chinese Professorship at Oxford, the proposal for which some time ago was defeated by a small majority, will again be brought under the consideration of the University Council next month. It appears that the University authorities are willing to establish a Chinese Professorship during the lifetime of Dr. Legge, the proposed first occupant of the office; but the Committee of Chinese merchants and others, of which Sir Rutherford Alcock is the Chairman, desire to found a permanent chair at the University, and are willing to contribute a considerable portion of the funds necessary for that purpose.

The Journal of the Franklin Institute for May gives, in addition to its usual engineering papers and essays on mechanical science, a mode of preparing a useful hygroscopic paper by Percy Smith. A bibulous paper is impregnated with a concentrated solution of chloride of cobalt. It is very sensitive to atmospheric variations, being blue in a dry atmosphere, changing to red when the air becomes humid.

Reviews.

DARWIN ON INSECTIVOROUS PLANTS.

"Insectivorous Plants." By CHARLES DARWIN, M.A., F.R.S., &c. With illustrations. London: John Murray, Albemarle-street. 1875.

LAST month circumstances compelled us to give only a brief notice of this very important and interesting work by Mr. Darwin, and we now gladly embrace the opportunity of presenting our readers with a more ample notice of it.

That fact is stranger than fiction is an old and well-known aphorism; yet it is so true and suggestive that anyone may well be pardoned who uses it on a fitting occasion, and surely its appositeness to the subject matter of this work cannot well be gainsaid. The consideration of the nature and operations of plants that feed upon animal substances is doubtless an interesting and withal an instructive one, since it will instruct us that all life is part of a harmonious system which is interchanged and entwined together in such a way that one department of the operations of nature cannot be considered as distinctly separated from all other parts; and further that fields of investigation which will interest and instruct all who have eyes to see, ears to hear, and intelligence to comprehend are around us even where on usually received ideas all appears to be old and well-known. Certainly with the eminent philosopher who presents this work to the world for our guide, no one can fail to be both interested and enlightened, even with regard to many things formerly thought to be old and well-understood.

Without preface or formal introduction, Mr. Darwin gives a very elaborate account of the nature and action of the Drosera rotundifolia, or the common sun-dew, with reference to the number of insects captured—description of the leaves and their appendages or tentacles—sketch of the action of the various parts, and of the manner in which insects are captured—duration of the inflection of the tentacles—nature of the secretion—manner which insects are carried to the centre of the leaf—evidence that the glands have the power of absorption—and the small size of the roots.

He then proceeds to describe the movements of the tentacles from the contact of solid bodies; the aggregation of the protoplasm within the cells of the tentacles; the effects of heat on the leaves; the effects of non-nitrogenous and nitrogenous organic fluids on the leaves; the digestive power of the secretion of drosera; the effects of salts of ammonia; the effects of various other salts, and acids, on the leaves; the effects of certain alkaloid poisons, other substances and vapours; on the sensitiveness of the leaves, and on the lines of transmission of the motor impulse.

Mr. Darwin then describes the structure and movements of some other species of drosera, as, for instance, *drosera anglica—drosera intermedia—drosera capensis—drosera spathulata—drosera filiformis—drosera binata*—and afterwards treats of the dionæa muscipula with reference to:—Structures of the leaves—sensitiveness of the filaments—rapid movement of the lobes caused by irritation of the filaments—glands, their power of secretion—slow movement caused by the absorption of animal matter—evidence of absorption from the aggregated condition of the glands—digestive power of the secretion—action of chloroform, ether, and hydrocyanic acid—the manner in which insects are captured—use of the marginal spikes—kinds of insects captured—the transmission of the motor impulse and mechanism of the movements—re-expansion of the lopes.

Attention is bestowed on the aldrovanda vesiculosa, which captures crustaceans, and on drosophgyllum — roridula — byblis — glandular hairs of other plants. The work concludes with the consideration of the pinguicula and utricularia.

As illustrative of the manner in which the subject is treated by the eminent writer, we present our readers with the following quotation from the opening chapter:—

During the summer of 1860, I was surprised by finding how a large number of insects were caught by the leaves of the common sun-dew (*Drosera rotundifolia*) on a heath in Sussex. I had heard that insects were thus caught, but knew nothing further on the subject. I gathered by chance a dozen plants, bearing fifty-six fully expanded leaves, and on thirty-one of these dead insects or remnants of them adhered; and, no doubt, many more would have been caught afterwards by these same leaves, and still more by those as yet not expanded. On one plant all six leaves had caught their prey; and on several plants very many leaves had caught more than a single insect. On one large leaf I found the remains of thirteen distinct insects. Flies (Diptera) are captured much oftener than other insects. The largest kind which I have seen caught was a small butterfly (*Cænonympha pamphilus*); but the Rev. H. M. Wilkinson informs me that he found a large living dragon-fly with its body firmly held by two leaves. As this plant is extremely common in some districts, the number of insects thus annually slaughtered must be prodigious. Many plants cause the death of insects, for instance the sticky buds of the horse-chesnut (*Æsculus hippocastanum*), without thereby receiving, as far as we can perceive, any advantage; but it was soon evident that drosera was excellently adapted for the special purpose of catching insects, so that the subject seemed well worthy of investigation.

The results have proved highly remarkable; the more important ones being—firstly, the extraordinary sensitiveness of the glands to slight pressure and to minute doses of certain nitrogenous fluids, as shown by the movements of the so-called hairs or tentacles; secondly, the power possessed by the leaves of rendering soluble or digesting nitrogenous substances, and of afterwards absorbing them; thirdly, the changes which take place within the cell of the tentacles, when the glands are excited in various ways.

It is necessary, in the first place, to describe briefly the plant. It bears from two or three to five or six leaves, generally extended more or less horizontally, but sometimes standing vertically upwards. The leaves are commonly a little broader than long. The whole upper surface is covered with gland-bearing filaments, or tentacles, as I shall call them, from their manner of acting. The glands were counted on thirty-one leaves, but many of these were of unusually large size, and the average number was 192; the greatest number being 260, and the least 130. The glands are each surrounded by large drops of extremely viscid secretion, which, glittering in the sun, have given rise to the plant's poetical name of the sun-dew.

Preliminary Sketch of the Action of the several Parts, and of the manner in which Insects are Captured.

If a small organic or inorganic object be placed on the glands in the centre of a leaf, these transmit a motor impulse to the marginal tentacles. The nearer ones are first affected, and slowly bend towards the centre, and then those farther off, until at last all become closely inflected over the object. This takes place in from one hour to four or five or more hours. The difference in the time required depends on many circumstances; namely, on the size of the object and on its nature; that is, whether it contains soluble matter of the proper kind; on the vigour and age of the leaf; whether it has lately been in action; and, according to Nitschke, on the temperature of the day, as likewise seemed to me to be the case. A living insect is a more efficient object than a dead one, as in struggling it presses against the glands of many tentacles. An insect, such as a fly, with thin integuments, through which animal matter in solution can readily pass into the surrounding dense secretion, is more efficient in causing prolonged inflection than an insect with a thick coat, such as a beetle. The inflection of the tentacles takes place indifferently in the light and darkness; and the plant is not subject to any nocturnal movement of so-called sleep.

If the glands on the discs are repeatedly touched or brushed, although no object is left on them, the marginal tentacles curve inwards. So again, if drops of various fluids, for instance, of saliva or of a solution of any salt of ammonia, are placed on the central glands, the same result quickly follows, sometimes in under half an hour.

The tentacles in the act of inflection sweep through a wide space; thus a marginal tentacle, extended in the same plane with the blade, moves through an angle of 180°; and I have seen the much reflected tentacles of a leaf which stood upright move through an angle of not less than 270°. The bending part is almost confined to a short space near the base; but a rather larger portion of the elongated exterior tentacles becomes slightly incurved; the distal half in all cases remaining straight. The short tentacles in the centre of the disc when directly excited, do not become inflected; but they are capable of inflection if excited by a motor impulse received from other glands at a distance. Thus, if a leaf is immersed in an infusion of raw meat, or in a weak solution of ammonia (if the solution is at all strong, the leaf is paralysed), all the exterior tentacles bend inwards, excepting those near the centre, which remain upright; but these bend towards any exciting object placed on one side of the disc. The glands form a dark ring round the centre; and this follows from the exterior tentacles increasing in length in due proportion, as they stand nearer to the circumference.

Mr. Darwin proceeds elaborately to consider the functions and action of these plants, narrating many interesting experiments, but nothing short of the reproduction of the entire work could do anything like justice to it.

DR. GRABHAM ON IDIOCY.

"Remarks on the Origin, Varieties, and Terminations of Idiocy." By George Wallington Grabham, M.D., Lond., President, Physician, and Superintendent of the Asylum for Idiots, Earlswood, Red Hill, Surrey.

This is a very interesting and instructive work on a subject little investigated. As far as space permits, we shall allow Dr. Grabham to speak in his own words:—

The time at my disposal being necessarily very limited, I will at once proceed to give short definitions of the terms *idiocy*, *imbecility*, *cretinism*, and *dementia*; and afterwards some particulars of the causes of these affections, as far as I have been able to ascertain them by inquiries in eight hundred cases.

Idiocy may be defined as "an absence or arrest of development of the intellectual and moral faculties, either congenital, or occurring in new-born children." *Imbecility* is generally taken to signify "a milder form of idiocy, not necessarily congenital, but supervening in infancy." *Cretinism* may be termed "an endemic form of idiocy or imbecility, in which there is, moreover, characteristic arrest of development, malformation, and deformity of the whole organism" *Dementia* differs from imbecility in being *a loss, more or less complete, through disease or injury, of faculties formerly possessed*. The causes of these affections may be divided under four heads, viz.:—Endemic; hereditary, or family-predisposing; parental; and accidental; any or all of which may be more or less combined. The same cause may produce effects differing with the patient's age at the time of its application: thus epilepsy will cause idiocy in early infancy; in more advanced youth, imbecility; and, later in life, dementia.

A somewhat singular fact may now be stated regarding the sex of the patients who have come under my notice. At Earlswood, the males are always twice as numerous as the females. Making every allowance for the supposition that female idiots are more tolerable in private houses than males, and, therefore, less frequently sent to asylums, it would still appear that a large majority throughout the country are of the male sex.

Nearly 65 per cent. of my eight hundred cases are stated to be congenitally defective; and, when we consider how difficult it is, even for a skilled observer, to detect idiocy in early infancy, we may feel sure that this percentage has not been overstated.

Hereditary predisposition is without doubt the chief agent in the production of mental deficiency; but it is extremely difficult to ascertain the real facts of the case, especially as it affects the upper classes of society, who appear to be almost more anxious to deceive themselves than their medical advisers on this point. Many of my patients not born with defective intellect have nevertheless inherited a predisposition which ultimately led to it. In about 18 per cent. hereditary taint is admitted; but I am convinced that it exists in a far greater proportion; indeed, I have, in numerous instances, found this to be the fact from observation of the parents, or inquiries among their acquaintances. A mother, from whom I could learn no history of mental disease, and who certainly showed no indication of it in my presence, was afterwards found to be frequently removing to new lodgings, because "poison was put down the chimney into her food." In another case, I learned, after strenuous denial of any mental affection in the family, that two of the mother's sisters had been insane, and that she herself was highly hysterical. Where actual mental disease cannot be ascertained to have existed, we frequently find history of neuroses, as chorea; and often a great degree of eccentricity in one or both parents. A lady tells me in a letter, that "Her late husband used to say that there was no such place as hell; but she hopes now that he has found out his mistake."

Intemperance in the parents is even more difficult to ascertain. In six cases only of my eight hundred is it stated as the probable cause, and in two of these there was also hereditary insanity. Doubtless, *habitual* intemperance does play an important part in the production of idiocy; but I have been quite unable to assign (as has been done by my predecessor at Earlswood) any particular type of idiocy to "drunkenness during conception" as its cause. This vice is extremely common with newly married couples of the lower orders of society, whose first children are nevertheless, as a rule, at least as healthy as those of more wealthy parents. Intemperance often leads to ill-usage or neglect of children, and may thus indirectly cause idiocy.

Consanguinity of the parents accounts (partially only) for about 6 per cent. of the cases which have been admitted into the Asylum during the last six years and a half. In 11 cases only of 543, the parents were first cousins, and no other cause could be ascertained. Where hereditary predisposition coexists with marriage of consanguinity, we frequently find, as might be expected, more than one child affected. We may therefore regard with less disfavour marriages between cousins, where there is no hereditary taint on either side.

The learned doctor then proceeds to further investigate classes of cases and individual instances, but space forbids us to enter further into the subject. We may, however, mention that this little work is a reprint by the inmates of Earlswood, with illustrations and notes, from the *British Medical Journal*.

PROFESSOR TYNDALL ON SOUND.

"Sound." By John Tyndall, D.C.L., LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution of Great Britain. London: Longmans, Green and Co. 1875.

We have here the third edition of this well-known work, one that, wherever science is taught, is universally the text book on sound. It has been carefully revised, and, as far as possible, amended. Besides additions of smaller importance, there is, in this edition, an account of an investigation Prof. Tyndall has, during the two past years, conducted in connection with the Elder Brethren of the Trinity House, under the title "Researches on the Acoustic Transparency of the Atmosphere, in relation to the question of Fog-signalling," and on this subject Professor Tyndall remarks that it was only by Governmental appliances that such an investigation could have been made; and says, "It gives me pleasure to believe that not only have the practical objects of the enquiry been secured, but that a crowd of scientific errors, which for more than a century and a half have surrounded this subject, have been removed, their place being now taken by the sure and certain truth of nature. In drawing up the account of this laborious enquiry, I aimed at linking the observations so together, that they alone should offer a substantial demonstration of the principles involved. Further labours enabled me to bring the whole enquiry within the firm grasp of *experiment*; and thus to give it a certainty which, without this final guarantee, it could scarcely have enjoyed."

The first brief publication of the investigation provoked some hostile criticisms; and Prof. Tyndall has, in his preface, taken the opportunity of replying to the principal of them, and at the conclusion of his preface he says:—

"'With the instruments now at our disposal, wisely established along our coasts, I venture to think that the saving of property, in ten years, will be an exceedingly large multiple of the outlay necessary for the establishment of such signals. The saving of life appeals to the higher motives of humanity.' Such were the words with which I wound up my report on fog-signals. One year after their utterance the Schiller goes to pieces on the Scilly rocks. A single calamity covers the predicted multiple, while the sea receives three hundred and thirty-three victims. As regards the establishment of fog-signals, energy has been hitherto paralysed by their reputed uncertainty. We now know both the reason and the range of their variations; and such knowledge places it within our power to prevent disasters like the recent one. The inefficiency of bells, which caused their exclusion from our enquiry, was sadly illustrated in the case of the Schiller."

Although this work has been translated into various languages, it is gratifying to hear that it has been produced in Chinese, and sold at the extraordinary cheap price of one shilling and eightpence. But on behalf of students in this country, we would just remark that they would like to be able to get the volume in English at that price.

In conclusion we earnestly commend this new edition to the careful consideration of students and others who desire to familiarise themselves with the science of sound.

NEW MUSICAL SOCIETY.

Proceedings of the Musical Association for the Investigation and Discussion of subjects connected with the Art and Science of Music. Founded May 29th, 1874-75. London: Published by Messrs. Chappell and Co., 50, New Bond-street, 1875.

THIS is the first yearly volume of proceedings of a new organization, one, considering the great importance of music amongst a civilized people, well worthy of as high a status as that of any of the learned societies in existence.

It appears that some gentlemen interested in the science and practice of music formed the idea that such a Society modelled on the plan of the other learned societies would be a great public benefit, and after a preliminary meeting this society was formed in May, 1874, the rules setting forth "that the members are to be practical and theoretical musicians, as well as those whose researches have been directed to the science of Acoustics, the history of music, or other kindred subjects, and that meetings for reading papers and taking discussions thereon and for experiments and performances strictly limited to the illustration of the papers, are to be held during sessions, which are to comprise the months of November to June; the meetings to take place at a somewhat unusual hour, viz., 5 o'clock, p.m. Concerts, or publications other than the proceedings, are, it appears, not intended to be given by the Society, and the Annual Subscription is One Guinea.

Considering that this is quite a new society, t is wonderful what a goodly array of subjects are included in these proceedings viz.

A paper by Dr. W. H. Stone, M.A., F.R.C.P., "On Extending the Compass and Increasing the Tone of Stringed Instruments;" and papers (Part I. and Part II.) by R. H. M. Bosanquet, Esq., M.A. Fellow of St. John's College, Oxon, F.R.A.S., F.C.S., "On Temperament; or, The Division of the Octave;" a paper by Sedley Taylor, Esq., M.A., Trinity College, Cambridge, "On a Suggested Simplification of the Established Pitch-Notation;" and a short description is given of a Mesotonic harmonium, playing from seven flats to seven sharps, by a new stop-action, exhibited by A. J. Ellis, Esq., F.R.S.; also papers by J. Baillie-Hamilton, Esq., "On the Application of Wind to String Instruments" (illustrated by an apparatus which will give some of the varied tones of a string organ); by Charles E. Stephens, Esq., "On the Fallacies of Dr. Day's Theory of Harmony; with a Brief Outline of the Elements of a New System;" by John Hullah, Vice-President, "On Musical Nomenclature;" by Dr. John Stainer, M.A, Musical Doctor, Oxon, "On the Principles of Musical Notation;" and by Alexander John Ellis, Esq., F.R.S., "Illustrations of Just and Tempered Intonation."

It seems a pity that the society did not make it one of its principal objects to take action to advance musical education, and improve the status of the musical profession. It is to be feared that unless practical objects of this kind are included in its programme it will, in a short time become a mere *dilletante* assembly.

TYNDALL ON LIGHT.

"Six Lectures on Light." By JOHN TYNDALL, D.C.L., LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution. London: Longmans, Green and Co. 1875.

THIS is the second edition of the lectures on light, which were delivered by Prof. Tyndall in America in 1872-1873. It differs very little from the first edition. The only material alteration seems to be the omission of Dr. Young's "Reply to the *Edinburgh Review*," the end contemplated by inserting this in the first edition having been gained. In lieu of the reply a portrait of Dr. Young is added as a frontispiece. There is also added in the appendix three brief addresses by distinguished Americans, viz., Professors Barnard, Draper, and White.

The call for a second edition speaks well for the estimation in which the work is deservedly held by students and others interested in this important branch of science, and we have no doubt this second edition will be sought after as much as the first has been.

HIGGINS' DIGEST OF PATENT CASES.

"A Digest of the Reported Cases Relating to the Law and Practice of Letters Patent for Inventions, decided from the passing of the Statute of Monopolies to the Present Time." By CLEMENT HIGGINS, M.A., F.C.S, of the Inner Temple, Barrister-at-Law. London: Butterworth's, 7, Fleet-street. 1875.

MR. HIGGINS has, with wonderful and accurate research, produced a work which is much needed, since we have no collection of patent cases of any kind which does not terminate years ago. There is not any branch of the law in which analysis is so likely to prove the safe method of exposition as the Patent Law. The almost metaphysical character of the subject, the all but inseparable comixture of law and general and technical science, and the nice—almost subtle—distinctions that have to be drawn between cases, which, as many men of good education and sound judgment assert, do not present any well-evidenced *differentia*; whilst the varying moods of thought in which the judges at different epochs approach the decision of patent questions, sometimes morbidly sensitive to the propriety of so construing the law as to ensure the vigorous repression of everything tending to "restraint of trade," and at other times taking broad views of the good policy of encouraging inventors by according to them special proprietary rights of limited duration.

The work is well arranged, and gives brief though comprehensive statements of the various cases decided from. We consider, too, that if an inventor furnishes himself with the digest and Mr. Campin's little Treatise on the Law of Patents, he will be able to be as much his own patent lawyer as it is safe for him to be.

DOWNING'S ELEMENTS OF PRACTICAL CONSTRUCTION.

"Elements of Practical Construction; for the Use of Students in Engineering and Architecture.—Part I. Structures in Direct Tension and Compression. With Atlas of Plates and numerous Woodcuts. By SAMUEL DOWNING, LL.D. Longmans and Co.

THIS is as complete a work of technical instruction as could well be expected. Seeing it emanates solely from an academic and not a workshop man, it is, of course, much fuller in information of the scientific than of the practical kind, treating in the present volume only of resistance to direct compression and tension, the subjects of elasticity, indirect compression and tension, transverse resistance, torsion, &c., being left for another volume. First the average ultimate resistance of each material is stated, then follows experimental proofs, and illustrations are given from actual structures. Examples of experiments have been collected from proceedings and transactions of learned societies, from reports of commissions, and from other sources. The treatment and properties of iron, cast and wrought, occupy a large part of the book; timber, stone, and brick following; bessemer steel being also brought under consideration.

BRASSEY ON UNARMOURED SHIPS.

"Unarmoured Ships. By THOMAS BRASSEY, M.P. Longmans and Co.

THIS, like all that comes from the pen of Mr. Thomas Brassey, is a clear and sensible statement of matters which are worthy of the highest consideration. It relates to the position and necessary utility of vessels of a medium size unincumbered by armour as ocean patrols. It in no degree militates against armoured vessels as heavy sea batteries.

ELEMENTARY SCIENCE.

"Magnetism and Electricity. By JOHN COOK, M.A.—"Chemistry." By ALEX. CRUM BROWN, M.D.—"Geology." By JAMES GEIKIE, F.R.S. Chambers.

ALTHOUGH we deprecate the multiplication of series of manuals, we, nevertheless, deem it our duty to name these as well worthy of use.

WARING'S CERAMIC ART.

"Ceramic Art in Remote Ages." Illustrated. By J. B. WARING. Day.

ALTHOUGH this book is a compilation, yet it is one which gathers up materials from many sources, many not readily accessible. It is, therefore, worthy of careful perusal and consideration.

LUBBOCK'S WILD FLOWERS.

"On British Wild Flowers considered in Relation to Insects." By Sir JOHN LUBBOCK, Bart., M.P. Macmillan.

THIS is a very interesting and instructive book, just fitted for being taken in weather like the present as a companion when strolling in the gardens and fields for holiday enjoyment.

ROSS'S APPARATUS FOR UTILIZING PETROLEUM AND OTHER HYDROCARBON LIQUIDS, IN LIEU OF COAL OR OTHER FUEL.

THIS invention has for its object certain improvements in apparatus and means by which to effect the combustion of hydrocarbon liquids by charging atmospheric air with their vapour, and thus rendering it inflammable, under such conditions as shall permit the operator or consumer to regulate the supply of vapour according to the purposes for which the carburetted air is required, and which shall also allow of hydro-carbon of various qualities being used in one or the same apparatus.

I am aware that the process of carburetting air by passing it through a vessel containing hydro-carbon liquids is not new, but the novelty and improvements which I introduce consist in making an apparatus by means of which the degree of vapour saturation of the air can be so regulated as to permit of the carburetted air or gas, when required for lighting purposes, being obtained of a uniform quality, by counteracting the variations of temperature which are occasioned by the evaporation in the carburetter, or by the change of seasons, and which have hitherto greatly interfered with the general use of carburetted air in lieu of coal gas. My apparatus also facilitates the utilization of the heavier and usually cheaper oils when the air or gas is required for heating purposes, by affording the means of increasing the formation of vapours from such oils.

With these objects I supply a convenient quantity of petroleum or other hydro-carbon liquids to a shallow vessel, to which I give the name of "*carburettor*." This I construct with several orifices, through one of which atmospheric air should be drawn or driven, and through such one of the others as may be selected by the operator; it will emerge more or less saturated with hydro-carbon vapour, in a state in which it is inflammable.

This carburettor must be so partitioned interiorly as to allow of the current of air passing over the surface of the liquid in a long and continuous current, and the channel to which the air is confined should be so connected with the orifices of inlet and outlet as to permit of the distance traversed by the air being diminished or increased, so that the air may be charged with more or less carbon vapour according as one or other of those orifices is used.

The carburettor should be filled with some spongy or fibrous material which will split up the current of air into innumerable small threads, which will thus be more quickly and thoroughly charged with the vapour, and it should be so constructed as to allow of the liquid it contains being conveniently warmed, when that is necessary, in order to increase the evaporation and consequent intensity of carburation of the air, either before or after the liquid enters the carburettor.

The air should be drawn or driven through the carburettor by means of a fan working with great regularity, such as an ordinary gas meter, and this may be set in motion by such mechanical contrivance worked by a falling weight or a spring, or water, or steam power, as may be deemed best adopted to the local circumstances and to the size of the carburettor. On emerging as inflammable gas from the carburettor, the same fan will suffice to force it into mains or pipes leading to the burners or other place of combustion, or of intermediate and temporary storage.

In lieu of atmospheric air, I sometimes employ gases of an inferior quality, such as poor coal gas, wood or peat gas, decomposed steam, carbonic acid, or oxide, more or less diluted with nitrogen or other vapours.

THE ARTIZANS AND INVENTORS PATENT BILL AMENDMENT COMMITTEE (1875).

THIS committee was formed at a conference of skilled Artizans and others, held at Mr. C. Graham Carttar's Chambers, No. 14, Clement's Inn, Strand, W.C., on Monday, the 22nd March, 1875, to consider the best means of inducing the Government to introduce amendments in their Patent for Inventions Bill, so as to lessen the preliminary cost of patents, and to simplify the modes of procedure, in the interests of artizans and inventors of small pecuniary means.

It now consists of Mr. Thomas Paterson, chairman, and 35 others. Its last report states that the committee has held 17 meetings, and that a deputation from the committee, which Mr. F. W. Campin was specially invited to attend, waited on the law officers on the 31st May, when the chairman, Mr. Campin, and F. H. Varley, explained the views entertained by the artizans and others represented, and replied to several queries which were put by the Attorney-General.

The committee having adopted, after lengthened discussion, a memorial to the law officers and the Lord Chancellor, the same was presented to them, and has been published in the SCIENTIFIC REVIEW.

A petition to the House of Commons, embodying the views of the committee, was prepared and signed by the chairman, treasurer, and hon. secretaries, and presented to the House by Mr. Thomas Brassey, M.P.

The chairman and Mr. Campin attended at the request of the committee, a meeting of the Patent Law Committee (1875), and also the conference called by Sir Antonio Brady, in April last. Many members of the committee attended, and took part in a meeting subsequently held at the rooms of the Society of Arts, called by the Inventors' Institute.

The committee having adopted a petition for general signature, it was largely circulated, and 21 similar petitions were presented to the House of Commons, principally through the exertions of the hon. secretaries. Besides these over 35 other petitions have been presented to the House. In conducting the agitation in connection with the objects of the committee, the hon. secretaries have been in correspondence or communication with many M.P's., noblemen, and gentlemen. The chairman and secretaries drew up and sent to the press a letter, setting forth the views of the committee; this appeared in the *Engineer*, *Engineering*, the *Society of Arts Journal*, the *Standard*, and other public journals. Other letters and paragraphs on the subject appeared in the London and country papers. In communication with several M.P.'s, the hon. secretaries arranged for notices of amendments to be given to the House of Commons. Reasons in support of these amendments were considered and adopted by the committee. In July the Attorney-General announced that the Government had decided to withdraw the Bill for this session. The expenses in connection with the committee have been kept as low as possible, but some have necessarily been incurred; these amount to £5 16s. To meet this a subscription of £3 11s. has been received, leaving £2 5s. still to be provided for.

THE SCARBOROUGH INCLINE CARRIAGE WAY.

THIS Steep Gradient Railway is certainly worthy of attention. We, therefore, now give a short description of it extracted from the *Scarborough Gazette*:—The gradient is very great, and it is said that this incline carriage-way is the first of its kind in England. The length of railway is 300 feet, on a radius of 33 degrees of incline. There are two handsome carriages, constructed by the Metropolitan Carriage Company, and calculated to carry fourteen persons each, one ascending as the other descends, occupying altogether about three or four minutes for landing and transit. These carriages are sustained by a crucial steel rope, capable of bearing a weight of 28 tons, whilst the utmost weight it is required to carry will never exceed two tons. This rope is also supplemented by another of equal strength as a safety rope. Messrs. Stewart and Bury, of Scarborough, are the architects; and Mr. Jowsey the contractor for the buildings, roadway, &c.; and the engineering department has been carried out by Messrs. Crossley Bros., of Manchester, celebrated for their gas engines, two of which are employed for pumping sea water used as a gravitating force to the cars, and also to supply sea water to the top of the cliff for bathing purposes. The carriage-way has been regarded for years as a desideratum for facilitating transit between the South Cliff and the Spa and South Sands. It is now a *fait accompli*.

THE DUTIES AND THE RIGHTS OF INVENTORS.

THE editor of an esteemed foreign contemporary has been, apparently, taking a tour through the dyeing districts of France and Belgium, with a view to study the practical working of the new "hydrosulphite vat" of Messrs. Schützenbergen and de Lalande. He reports that the working of the new process is satisfactory, and the saving in indigo very important. But he considers that the royalties charged by the inventors for licences to work under their patent are extortionate. He adds, almost pathetically, that in France and Belgium no one can dye a pound of wool on this principle without obtaining a licence. This is a remarkable thing to be regretted by one who, like our contemporary, has pleaded earnestly and ably for the introduction of the English patent code into his own country—Germany, and has shown that the German inventor, finding no sufficient protection at home, carries his improvements to England or to America. Of course, if a patentee demands exorbitant royalties he merely prevents the adoption of his process, and cuts himself off from the emolument which he might otherwise have secured.

But this is not all: our contemporary whilst in Belgium chanced to see a letter in which M. Felix de Lalande, one of the inventors and patentees, declares that he has received numerous inquiries from Germany which he does not condescend to answer. Upon this our contemporary waxes wrath, and calls on German dyers to show the "arrogant Frenchman" that they can manage the process without his advice. We must confess that upon the present posture of the affair we cannot share in our contemporary's indignation. The invention is patented in France and Belgium, but not in Germany. Why not? Very possibly, because application for a patent has been there made in vain—a very common case, especially, we believe, if the applicant be a foreigner. Now we know that chemists are too commonly expected to give "advice gratis," not, like physicians, to the poor, but to wealthy manufacturers, and in England even to municipal bodies and to Government departments. And, at the same time, they are, unlike the members of other professions, expected to be infallible.

It is not stated that any of the Germans who wrote to M. de Lalande for advice had tendered him a fee. Might he not then with perfect justice have replied: "You refuse me all protection in your country, and then, adding insult to injury, dozens of you coolly write and ask me to give you gratuitously detailed instructions how you may best appropriate my invention!" A pirate might just as well expect merchants to send him a full account of what vessels they were about to send across the seas which he haunted. International patent-right is perhaps a long way off in these days, when even inland patent right is threatened. But it is a shamful thing for countries like Holland and Switzerland to avail themselves right and left of the inventions of foreigners, and to refuse them all protection.

Patents are branded by the ultra free-trade party with the odious name of monopoly. But if our laws grant to a man for the short term of 14 years the monopoly of something which, but for him, would have had no existence at all, they are far more liberal to others who have no such claims to urge. Suppose a number of persons band themselves together and propose to supply some town with gas, or with water, Parliament will give them the monopoly of so doing, not for seven or 14 years, but for ever! Foreign nations, more wisely, merely grant to such companies a concession for a limited term of years, so that the undertaking, like a patent, ultimately becomes public property. We quote the above from our esteemed and able contemporary, the *Chemical Review*.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 130.)

On June [illegible]th.—2371 to 2388.—H. S. Haas. Cleansing and bleaching jute, hemp, flax, and cotton.—J. W. Parker. Steam engines.—L. A. Valette. Mechanical appliance for turning the leaves of music, being applicable to all kinds of music stands, whether for pianos or otherwise.—J. C Martin. Manufacture of emery and other wheels used for grinding or polishing, and apparatus employed therewith.—L. B. Bertram. Apparatus for damping copying paper.—H. Cameron and J. W. Hill. Horse rakes.—F. J. Smith. Apparatus for flushing or cleansing urinals, water-closets, sewers, and for other analogous purposes.—E. Guthrie. Apparatus used in the erection of concrete buildings.—S.

Lowe, W. Renton, and J. Johnson. Machine or apparatus for cutting "flocks" or rags or other fibrous material.—W. Johnson. Machine for cutting and shaping the soles and heels of boots and shoes.—F. W. Brothers and C. Brothers. Apparatus used in the manufacture of gas.—J. N. Adorno. Watches and clocks.—H. E. Newton. Valves and valve cocks for steam and other motive-power engines (com.)—G. E. Miles and J. Tonge. Apparatus for drawing beer and other liquors from casks or barrels.—A. Chambers. Pneumatic signals for railways.—A. Browne. Construction of casters (com.)—J. M. Holmes. Gas stoves for cooking and heating (com.)—G. Day. Arrangement of check rein and kicking strap.

On July 1st.—2389 to 2396.—J. Morce. Compositions for cleansing and purifying the teeth and for sweetening the breath.—E. W. Roxby and W. Pearson. Safety-valves for steam-boilers or other vessels.—E. P. H. Vaughan. Method of and processes for preserving and rendering impervious to moisture threads and tissues of hemp, linen, cotton, wool, and silk (com.)—J. G. Rollins. Horse rakes (com.)—W. H. Phillips. Apparatus for producing pictorial effects.—E. H. Huch. Burner of petroleum lamps and cooking apparatus.—H. A. Bonneville. Electro-magnetic telegraphs where induced currents are used, and also apparatus for producing such induced currents (com) (Complete specification.)—C. A. F. Rochaz. Breech-loading fire-arms and their accessories.

On July 2nd.—2397 to 2404.—T. Wrigley. Construction and arrangement of correspondents' compendium.—W. Whittbread. Manufacture of mono-calcic phosphate.—E. Reynolds. Manufacture of cranked shafts and axles.—C. A. Jobert. Construction of ships and vessels, and the mode of propelling the same for rapid transit on water.—E. G. Banner. House traps for preventing the passage of sewer gas into dwellings from sewers, drains, or cesspools.—T. Griffith and W. P. Thompson. Manufacture of a zinc sulphide and the application of the same to useful purposes (partly com.)—W. H. Carmont. Apparatus employed in forging tyres, hoops, and rings.—J. Bedford. Machinery or apparatus for grinding corn.

On July 3rd.—2405 to 2419.—G. Westinghouse, jun. Pneumatic brake and intercommunication signalling apparatus for railway trains.—W. A. Lyttle. Means and apparatus for producing animal charcoal and other filtering materials for use as purifiers of liquids and gases, and for reviving or restoring the same when exhausted by use.—J. H. Ladd. Apparatus for facilitating the tamping or adjustment of the rails of railways (com.)—F. W. Crossley and W. J. Crossley. Crabs, winches, or other machinery for lifting or hauling.—F. C. E. M. Bénic. Construction of ships and other navigable vessels.—F. M. A. Chauvin, L. H. Goizet, and A. Aubry. Electric submerged lamp.—H. C. Wordsworth. Respirators.—W. Brookes. Means or apparatus for the manufacture of illuminated gas from petroleum or other hydrocarbon oil (com.)—D. Coughlin. Manufacture of ice and the machinery or apparatus employed therein, also applicable to other cooling and refrigerating purposes. G. E. Jeffery. Machines for making hay.—N. Thompson. Stoppers for bottles, jars, and other hollow articles.—B. J. B. Mills. Construction of multitubular steam-boilers (com.)—R. A. Allardyce. Wind shute or wind sail.—H. Jewitt. Toy (com.)—F. Le Maistre. Means of attaching ties, scarves, or cravats.

On July 5th.—2420 to 2433.—F. T. Davey and A. P. Hutchison. Cooking stoves or kitchen ranges.—J. Wolff and R. Betley. Production of aniline dyes.—J. Wolff and W. A. Byrom. Obtaining aniline and the employment of the same, or of compounds thereof.—J. Bowing. Manufacture of cements.—C. Heinz. Mechanical kneading trough.—R. D. Saunders. Working the brakes of railway trains and signalling on railway trains.—R. T. W. Huthwaite. Watering cans.—R. T. W. Huthwaite. Wheelbarrows.—J. Simmonds. Means and apparatus for conveying or carrying human beings or objects into mid-air.—W. H. Potter. Ships and navigable vessels.—J. L. M. George and T. Prioux. Ink pencils.—J. P. Fison. Guard for thrashing machine drums.—W. Nicholson and G. Scovell. Toilet looking glasses.—G Haseltine. Machines for opening and preparing cotton (com.) (Complete specification.)

On July 6th.—2434 to 2442.—W. Stroudley. Apparatus for and the method of signalling between parts of a railway train, parts of which apparatus are applicable to or for other purposes.—G. Severn. Refrigerators for cooling wort or other liquids.—R. Wilson. Hydraulic presses and apparatus connected therewith.—G. de la Perrelle. Hermetically sealing and preserving food and other perishable articles, and the apparatus or receptacles used in containing and transporting the same (com.)—E. Ormerod. Apparatus to be applied to winding machinery (used in coal and other mines) for the prevention of accidents from over-winding, which apparatus is also applicable to hoists and for other similar purposes.—W. R. Lake. Toys to be used connection with lamps (com.)—W. Hinds and D. Nicoll. Machinery for laying down and taking up detonators or fog signals on railways, and signalling thereby.—J. A. C. F. Clouet. Mode and means for the manufacture of bi-chromate of potash.—H. Schallehn. Wire mattresses and seats (com)

On July 7th.—2443 to 2453.—D. Brown. Lifeboat rafts for saving life at sea.—A. H. Cramp. Apparatus for measuring and cutting button holes.—H. B. Barlow. Machinery for burring or cleaning wool, cotton, flax, silk, and other fibrous substances (com.)—E. J. Thom. Apparatus for filling bottles and other vessels with aerated and other liquids and for drawing off the same.—T. Green. Mowing and grass-cutting and turf-cutting machines.—J. Wolff and R. Betley. Production of dyes from naphthaline and its derivatives.—E. Mincher. Machinery or apparatus for manufacturing buttons and other similar discshaped articles from bone, vegetable ivory, and wood.—F. Weintraud and R. J. S. Joyce. Buttons.—W. S. Thomson. Ring and traveller used in spinning (com.)—H. E. Newton. Mortising machines (com.)—E. Wimshurst. Construction of rotary engines.

On July 8th.—2454 to 2467.—R. Hill. Construction of furnaces for heating and drying.—H. W. J. Ward and W. Ward. Brick-making machinery.—M. A. Pradier. Mode of fastening and unfastening studs, sleeve links, and solitaires by means of the screw principle, being in one piece.—P. Jensen. Sewing machines, more particularly applicable for button hole work (com.)—G. A. Bartleet. Machinery or apparatus to be used in the washing, cleansing, and dyeing of wool and other fibres and yarns (com)—O. Nordenfeldt. Substance or compound to be employed for explosive purposes (com.)—T. Griffiths and W. P. Thompson. Combination and manufacture of certain metallic sulphides and sulphates, and their application to useful purposes (partly com.)—W. R. Jolley. Method of securing and launching life rafts or deck houses.—E. T. Hughes. Feed attachment for power presses (com.)—A. Higginson. Engines and pumps.—P. Carlyon and F. Titterton. Tools or apparatus for expanding tubes.—S. E. Knight. Construction of chimney pot.—H. Hughes. Additions to sewing-machines.—G. Haseltine. Casting of metals and apparatus therefor (com.)

On July 9th.—2468 to 2483.—G. A. Hirzel. Disintegrators and the arrangement for driving or actuating the same.—G. D. Davis. Rudders and machinery or steering gear for working rudders.—R. Vaile. Rotary engine for applying the motive power of steam, water, atmospheric air, and similarly acting motive powers —A. Sézille. Manufacture of malt.—W. E. Gedge. Apparatus for signalling on railway trains (com.)—W. White. Apparatus used in the manufacture of gas.—J. Clark. Furnaces for the prevention of smoke.—P. Jensen. Process of and apparatus for forming screw-nuts and other hollow articles (com).—F. Geary. Means and apparatus for training and testing dogs.—Francis J. Odling. Process and apparatus for manufacturing fibrous slabs by rolling pressure; the said apparatus being applicable also in expressing oils or other liquids from seeds or pulps.—A. M. Clark. Safety winding apparatus for lifts and other similar purposes (com.)—W. Hutton. Machinery for the manufacture of cut nails.—E. T. Hughes. Machinery or apparatus for washing and scouring wool (com.)—D. G. Fitz-Gerald. Treatment of ores of lead, the separation of metals contained therein, and the production of sulphuric acid.—G. T. Bousefield. Machine for the manufacture of rubber belting (com.)—E. H. Huch. Soldier's equipment.

On July 10th.—2484 to 2494.—W. H. Parker and J. Elliott. Construction of blind roilers.—R. Atkin. Construction, rig, and equipment of life boats, rafts, and other vessels, and means for lowering and launching the same.—G. T. Bousfield. Apparatus for the manufacture of sugar in lumps or bars (com.) (Complete specification).—John Rigby and Jos. Rigby. Ventilating and apparatus therefor, part of which apparatus may be used for warming.—J. H. Johnson. Treatment of substances capable of being employed for the production of paper pulp (com.)—S. Needham. Lamps and lamp boxes for tram cars, applicable for other purposes.—W. A. Blake. Washing machines.—F. E. Duckham. Machinery for raising and lowering landing stages and other similar platforms or structures.—T. King. Direct-acting steam pumps.—J. Noad. Machinery and apparatus for and the mode of manufacturing fibre from wood, rags, and such like materials.—W. Dawes. Converting reciprocating or vibratory motion into circular or revolving motion.

On July 12th.—2495 to 2511.—C. Heinzerling and H. Liepmann. Recovery and utilization of refuse cautchouc and gutta-percha.—T. Pirie. Machine for thinning turnips and other plants sown in drills.—D. Mackinnon. Writing instruments. (Complete specification).—W. R. Gade. Apparatus for saving life in case of shipwreck.—R. Patrich. Rotary pumps and engines. (Complete specification).—E. De Pass. Breech-loading fire-arms (com.)—F. Niblet. Safes, strong rooms, and similar structures for containing valuable property and fastenings for the same.—J. Gray. Glove-sewing machines (com.)—C. W. Mills. Apparatus for discharging grain and other materials from vessels.—T. Pritchard. Mode of manufacturing wrought iron water spouting.—L. Lindley. Mode of working lace machines whereby they are enabled to produce various descriptions of fabric not hitherto made thereon.—H. J. F. Rose. Apparatus for purifying and assorting middlings. said apparatus being adaptable as a grain cleaner and separator.—C. E. J. Grube. Machine for cutting conical wheels.—W. R. Lake. Liquid meter (com.)—W. R. Lake, Galvanic apparatus and contrivances connected therewith, applicable to telegraphic and lighting purposes (com.)—A. M. Clark. Machinery for the manufacture of paper in separate sheets (com.)—M. E. West. Mechanism for operating sewing and other light machinery.

On July 13th.—2512 to 2525.—T. J. Barnard. Economical and effectual calcination and chlorination of poor and other ores.—L. O. Thayer. Compounds for dental plates and other purposes (com.) (Complete specification).—C. J. Galloway and C. H. Holt. Steam-boilers. (Complete specification.)—G. Tubbs. Self-acting latches or fastenings.—W. R. Lake. Chain cables (com.)—M. Neuhaus. Means and appliances for signalling at sea and on land (com.)—Sir S. Canning, Knt., and H. F. Joel. Pneumatic signalling or communicating apparatus, and the mode of and apparatus for testing the transmitting tubes for the same, applicable also to the testing of gas and other pipes or tubes.—S. Z. Lloyd and B. W. Rogers. Machinery for the manufacture of screws.—A. M. Clark. Fulling mills (com.) (Complete specification).—C. J. Wollaston. Purification and decolorization of dye waters and waters which have been employed in washing lead minerals.—H. W. Sambridge. Shades and globes for gas-lights and lamps of every description.—H. E. Newton. Apparatus applicable to burners for lighting purposes (com.) — C. Sholl. Direct-acting pneumatic hammers for crushing ores and for other purposes.—S. A. Da Silva. Fore and aft sails and certain parts connected therewith, so as to rapidly convert them into triangular sails.

On July 14th.—2526 to 2534.—W. Spence. Sewing machine shuttles (com.)—L. von Wojewodsky. Means for use in lighting cigars and other forms of tobacco.—A. Chevallier. Manufacture of bricks and slabs.—H. Lee. Construction of "swivel looms."—J. F. M. Pollock and H. Powley. Grinding pans applicable to mortar mills and other apparatus for grinding clay and other substances.—E. Wild. Self-acting regulator for bottling beer trays for preventing waste of beer or ale, caused by overflow.—J. Hardaker. Mode of applying "self-acting temples" to looms, and the means or apparatus employed therefor.—R. Thompson.

Washing and wringing machines.—J. M. Plessner. Cap or stopper mounts for perfume and liquid smelling bottles.

On July 15th.—2535 to 2548.—S. B. Ailport. Instrument or apparatus for guaging or measuring the internal diameters or bores of gun barrels, tubes, and tubular articles.—E. Sèches. Defensive arms or shields.—J. P. Smith. Mechanism for cutting and surfacing metal, wood, and like substances.—T. Stafford and R. L. Hilton. Method of and means for marking or setting out carpentry and joiners' work.—J. Nicholas. Apparatus for indicating the levels of water or liquid in reservoirs, ships' holds, steam generators, and other places.—W. R, Harris. Machinery for manufacturing heads or harness for looms.—M. C. Denne. Arrangement and method of attaching strips or pieces of wood to be used for lighting fires.—S. Heath. Machine for punching leather, cloth, and other substances of a similar kind.—J. H. Smith. Method of and apparatus for cutting and chasing bolts, studs, screws, and such like articles.—S. Coste. Ventilating apparatus.—M. Wilson. Stench trap.—M. Smith and M. H. Smith. Apparatus to be employed for annealing wire and continuous strips of metal, and for heating for the purpose of hardening and tempering the same.—U. Catlow and R. Hoyle. Stoppers for bottles and modes of purifying and protecting the same, also applicable to other similar articles.—T. C. Jones. Sail hank (com)

On July 16th.—2549 to 2556.—G. Keel and J. Cheshire. Skates for skating on artificial ice or other plain surfaces.—M. M. G. Merrall and E. R. Merrall. Machinery or apparatus for securing or washing wool or other fibres.—A. Macdonell. Machinery for filling and corking bottles —T. Pike. Manufacture of boots and shoes.—J. L. Boone and E. Detrick. Machine for sewing an overseam or overhand stitch. (Complete specification.)—B. C. Sykes. Apparatus for heating water.—R. T. Heape. Carding engines.—C. R. Walker. Apparatus for sinking cylinders, applicable also for sinking wells.

On July 17th.—2557 to 2565.—F. W. Grauhan. Apparatus employed in the filtration of water, sewage, and other fluids.—E. G. Burling. Manufacture of pianos.—J. H. Dennis. Manufacture of sulphate of copper —T. Muir. Manufacture of meal and flour from wheat, maize, and other grain, and obtaining a valuable product during the said manufacture.—J. P. Smith and P. Woodrow. Machinery for forging and shaping metals.—J. Westmorland. Ventilating dwelling houses and other buildings.—J. Livesey and J. Edwards.—Means and apparatus for locking the points of railways.—T. A. Hequet. Electro-magnets. — W. L. Powleson. Steam superheaters (Complete specification.)

On July 19th.—2566 to 2573.—G. L. Shorland. Connection with fire-places, fire-grates and stoves, employed in the warming of rooms and buildings.—E. G. Brewer. Machinery or apparatus for signalling (com.)—F. J. Talbot. Coupling buffers for railway purposes.—G. Kirk and W. Spivey. Samples employed in looms for weaving.—J. Shaw. Means or apparatus for connecting bobbins and spindles together in the processes of spinning and doubling.—J. Sylvester and W. Bridgett. Manufacture of lace on twist lace machines.—J. M. Sagar-Musgrave, J. B. Akeroyd, and D. Ward. Pump buckets, and valves for the same.—J. P. Prince. Syringe for surgical purposes.

On July 20th.—2574 to 2590.—F. J. W. Packman. Condenser for steam-engines.—J. A. Hes. Manufacture of artificial fuel blocks.—W. Wood and J. W. Farries. Regulating the motion of the feathering floats of paddle wheels and the mechanism employed therefor. — W. Gray. Heating and cooling greenhouses, vineries, and other analogous structures.—T. Schofield. Skip and basket guage.—W. R. Lake. Revolving cylinder pistol (com.)—W. E. Cadman. Decorating or ornamenting articles of dress and other articles in imitation of India embroidery or needlework.—A. L. Normandy. Distilling machinery and the mode of working the same.—J. Richards. Brake apparatus for road vehicles, and restraining runaway horses.—I. Levy. Playing cards. — J. H. Johnson. Steam-engines. — F. Bolton and P. Manly. Mowing and reaping machines.—E. Davies, J. Leyland, G. Partington. Machinery or apparatus for manufacturing blank bolts and set screws, and for partially making untapped hexagon, square or other shaped nuts for screw bolts.—J. Jefferson, C. Jefferson, L. Jefferson, and M. Jefferson. Machinery for washing wool and other fibres.—A. Clovier and A. V. Deschamps. Tanning, and apparatus therefor.—C. Mace and T. R. Carr. Steam-boiler furnaces.—R. Barclay. Machinery for printing metal plates and fixing durable coloured impressions upon metal plates.

On July 21st.—2591 to 2605.—H. A. Bonneville. Machinery or apparatus for fixed machines for spinning or twisting wool and fibrous materials in general (com.)—G. F. Bradbury and H. Lomax. Sewing machines. — J. Ankers. Means and apparatus for lubricating the bearings of the axles of waggons known and distinguished by colliers and miners as "corves." (Complete specification.)—J. Macneill. Water meter.—S. Houldsworth. Looms for the manufacture of tufted carpets and other tufted pile fabrics.—J. W. Edison. Machinery for grinding corn and other materials.—J. Tweeddale. Directors for delivering liquids from hose or tubes.—W. Lyon. Apparatus for laying out paper, envelopes, or cards, for bordering with black or other pigment.—R. Wilson. Steam and other elastic fluid engines.—F. J. Eyre. Construction of screw propellors with adjustable and feathering blades. — A. Kitson and J. Naylor. Self-acting means or apparatus for closing the doors of railway carriages and locking and unlocking the same.—W. R. Lake. Umbrella frames (com.)—J. Monteith. Construction of velocipedes.—W. Birrell. Apparatus for regulating the pressure or production of .gases and liquids.—J. H. Johnson. Blowers or apparatus for compressing or forcing fluids (com.)

On July 22nd.—2606 to 2615.—E. Blencowe. Fittings and action of roller-blinds.—S. Hallam and J. W. Lamb. Apparatus for allowing the steam to escape from steam-boilers when the water is too low.—J. Fayad. Pen.—F. Dixon. Treatment of wood-casks, or vessels, or staves thereof, for the storing and preservation of beer, wine, spirits, and other liquids, also applicable to the preservation of animal and vegetable substances.—W. J. Warner. Machinery and apparatus for charging and discharging gas retorts.—M. Burnett and H. Hornsby. Lubricator for journals. — E. Bates and R. S. Thornton. Machinery employed for the manufacture of nails.—T. A. Dillon. Method of embossing thin metal sheets with copies of manuscript writing, engravings, printed matter, and pictorial subjects by means of photography.—H. E. Newton. Looms (com.)—W. R. Lake. Motors for driving sewing machines, coffee mills, and other light machinery or apparatus (com.)

On July 23rd.—2616 to 2627.—S. Barnett. Apparatus for controlling, regulating, measuring, and arresting the flow or discharge of fluids or liquids and preventing waste thereof. — J. Whittle. Metallic or other rope couplings or cappings for railway, colliery, or other purposes.—J. Howard and W. Cox. Saddle-girth tightener.—W. C. Russell. Log or apparatus for measuring the speed of vessels.—S. S. Hellyer. Apparatus for preventing waste of water.—D. Gill. Methods and apparatus for neutralizing and deodorizing the poisonous and noxious gases emitted from sewers and drains, and also the sewage matters contained therein. (Complete specification.)—C. F. Cooper. Saving ships, such invention being named "Ship saving and sounding machine."—J. H. Johnson. Manufacture of wadding, batting, and felted fabrics, and the machinery or apparatus employed therein (com.)—J. A. Novello. Improvements in vessels, and propelling the same.—W. Riley. Apparatus for lighting fires.—E. G. Brewer. Apparatus for mixing gas-producing agents, more especially applicable to the development of pressure in that class of fire-extinguishing agents known as "extinctors" (com.)—W. Cheetham. Looms for weaving.

On July 24th.—2628 to 2642.—T. Butterworth. Machinery for spinning, rolling, compressing, and winding tobacco.—W. McIntyre Cranston. Machinery or apparatus for collecting and for binding grain-straws and similar crops in o bundles or sheaves (com.)—A. W. Rimington. Apparatus for registering the delivery of measures of liquids or solids.—G. H. Stakartt. Action of the centripetal and centrifugal forces as a motive power.—R. W. Morris and J. C. Hunter. Apparatus for registering the rise and fall of liquids. — F. R. Lucas. Submarine cables.—M. J. Roberts. Water-level indicating and low-water alarm apparatus for steam boilers.—M. J. Roberts. Apparatus for signalling or communicating between different parts of railway trains; part of the invention being also applicable to other purposes.—J. F. Stead and J. Littlewood. Looms.—J. Hobday. Paper-machinery.—W. Gray. Apparatus for gathering, elevating, and delivering hay and other crops.—George Goldsmith. Gas meters.—P. Adie. Apparatus for clipping horses and other animals —S. B. Walmsley. Combing machines.—H. Thacker. Means for printing and decorating metal plates.

On July 26th.—2643 to 2650.—H. Conradi. Couplings for effecting the coupling of wagons, carriages, vans, or any kind of railway vehicles from the side (com.)—G. Beardsley. Apparatus applicable to bobbin net or twist lace machines for manufacturing all kinds of woven fabrics which heretofore have been made in looms.—J. Rowley. Machinery for splitting or cleaving wood, and for making it up into bundles. C. Schouberszky. Manufacture of double-bedded sofas or other seats.—J. H. Johnson. Treatment of sugar cane for the extraction of sugar therefrom, and the utilization of the trash or residuum, and the machinery or apparatus employed therefor (com.)—S. Firth. Knitting machinery.—H. A. Bonneville. Type-setting machines. (Complete specification.)—F. Von Grubinski. Machine for reaping and mowing.

On July 27th.—2651 to 2663. — W. Goode. Preventing the knives for grass-mowing machines and reaping machines from becoming clogged.—E. Singleton. Apparatus or means designed to secure the consumption of smoke from the furnaces of steam boilers.—T. Howard. Purification of gas.—J. F. Brown. Weaving. — J. Mitchell. Machinery or apparatus employed in the manufacture of biscuits.—R. Davison, B. P. Walker and H. J. Hainge. Pavements, roads, and ways.—W. Clark. Circuit closers for electric railway signalling apparatus (com.) (Complete specification.)—T. Titley. Machines for pressing bricks or other plastic forms.—R. Heydemann and A. Klinkmann. Potato-digging machine.—J. Grice. Axles for carriages.—W. R. Lake. Method of measuring and indicating the quantity in a roll or package of cloth or other like material (com.)—A. G. Haskell. Useful life-preserving bed. (Complete specification.)—W. Ibbotson. Machinery for making paper.

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